MARIN WATER

Strategic Water Supply Assessment

BOARD WORKSHOP #7

September 13, 2022

Workshop Agenda: Strategic Water Supply Assessment

- Project Update
- Summary of Water Management Alternatives
- Alternatives Evaluation Process
- Summary and Next Steps
- Q&A

Strategic Water Supply Assessment: Schedule

- **September 13 – Summary of Water Management Alternatives**
- September 27 – Evaluation of Water Management Alternatives
- TBD – Public Workshop
- TBD – Draft Portfolios and Strategies
- TBD – Recommended Roadmap(s)

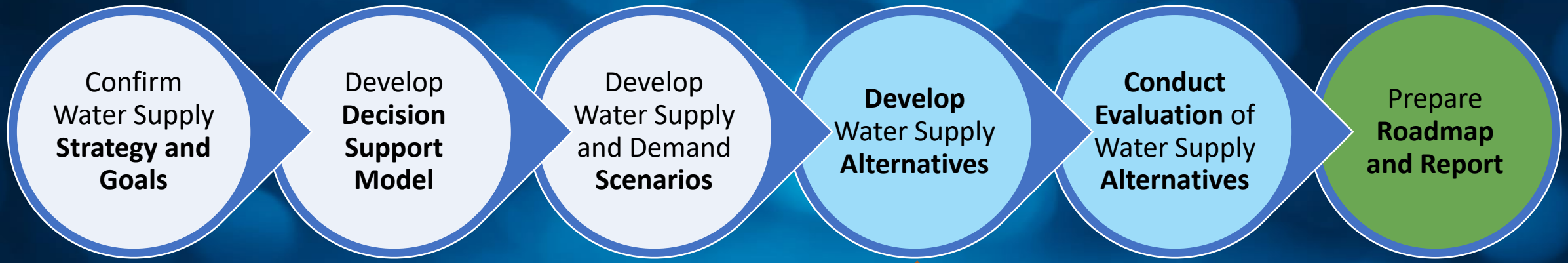
Process for Assessment

Key Project Scope Elements

Understanding Current Risks & Establishing Goals

Identifying & Evaluating Alternatives

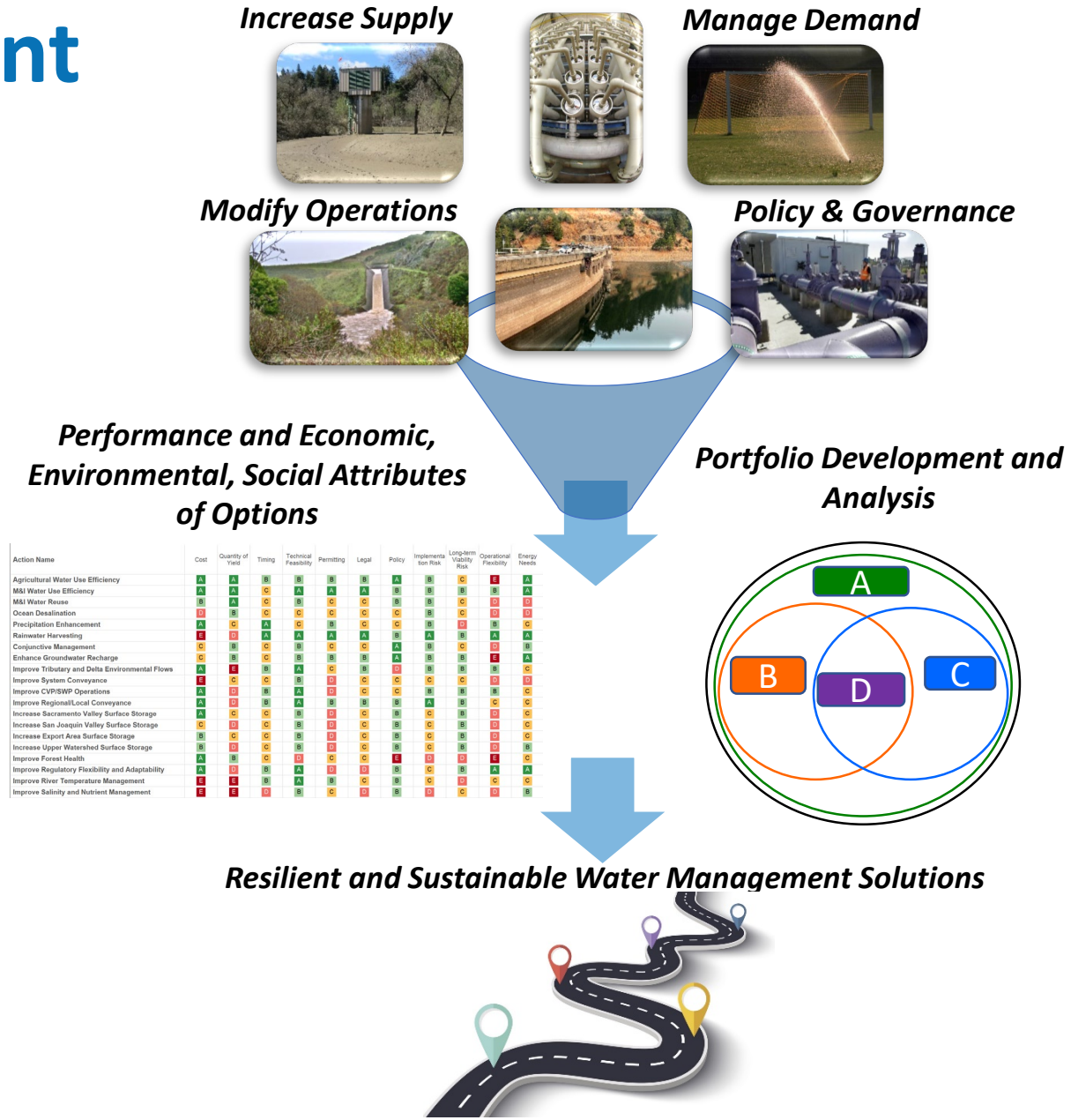
Recommendations & Path Forward



We are here

Water Supply Assessment Process

- Consider a broad range of water management alternatives
- Identify most promising alternatives
- Evaluate alternatives for performance and other economic, environmental, and social criteria
- Explore strategic combinations of alternatives
- Develop roadmap with specific project, pathways, and triggers to achieve resilient and sustainable solutions



Water Management Alternatives

Water Management Alternatives Considered

- Baseline – Existing water supply system
- Water Conservation
- Sonoma-Marin Partnerships
- Local Surface Storage
- Water Purchases with Conveyance through Bay Interties
- Desalination
- Recycled Water

Assumptions & Estimates

Assumptions & Estimates

- Water Management Alternatives – Level of Development
  - Developed from review of previous water supply assessments for the District
  - Review of project elements and updates based on team's related experience
  - High-level technical evaluations of alternatives
  - Reviewed conveyance needs and developed concept-level routing and sizing
  - Preliminary modeling of some alternatives to support yield estimation
- Work Continuing to Refine Alternatives
  - Yield estimates are for new supply – expressed as acre-feet per year of new supply
  - Operational changes to integrate and optimize use of new supply is important and is underway
  - Modeling forthcoming to evaluate how yields translate to drought benefit

Assumptions & Estimates

- Cost Assumptions:
  - Class 5 Cost Estimates
    - Typical expected accuracy range for Class 5 estimate is –20 to –50 percent on the low side and +30 to +100 percent on the high side.
    - Support the relative cost comparison of alternatives
  - Capital Costs and Annual O&M Costs
  - 30-year Project Planning Period
  - 3% Interest rate
- 3 Types of Cost Estimating Approaches:
  - Independent evaluation using Jacobs' cost estimating tools
  - Updated estimates from previous studies escalated to reflect 2022 conditions
  - Costs from comparable related projects

Water Management Alternatives Summary

Water Conservation

1. Water Conservation Program
2. Regulatory Driven Program

* As presented by staff to Board on 9/6. Will adapt to any changes based on additional review findings.

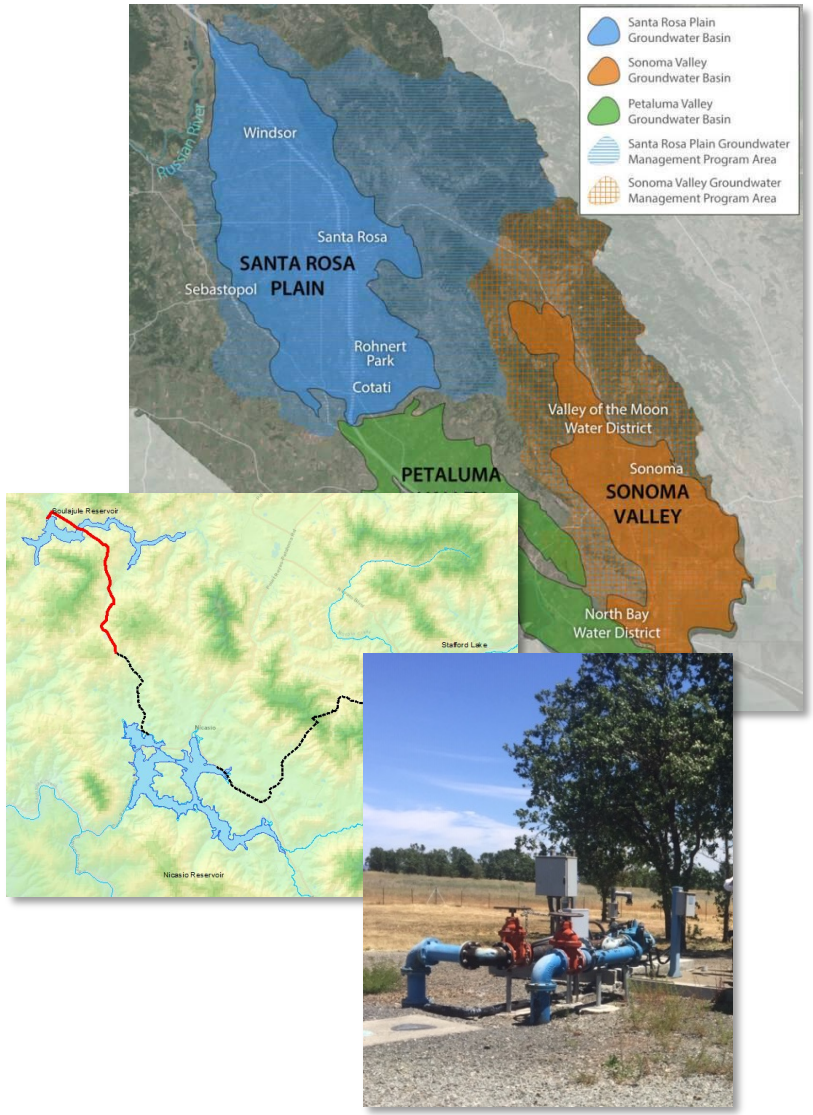
Water Conservation Options Yield and Cost Summary

Option	Potential Demand Reduction (AFY)	Capital Cost ($M)	Annual O&M Cost ($M)	Cost Range Estimate ($/AF)
1. Water Conservation Project	**4,000**		$1.7	**$1,800**
2. Regulatory Driven Project	**5,560**		$5.0	**$4,000**

* As presented to Board on 9/6. Water savings estimated for 2045.

Sonoma-Marin Partnerships

1. Maximize Use of Sonoma Water (Existing Facilities)
2. Maximize Use of Sonoma Water (Resolve Conveyance Bottlenecks)
3. Maximize use of Sonoma Water (Dedicated Conveyance to Nicasio Reservoir)
4. Groundwater Well Rehabilitation
5. Regional Groundwater Bank

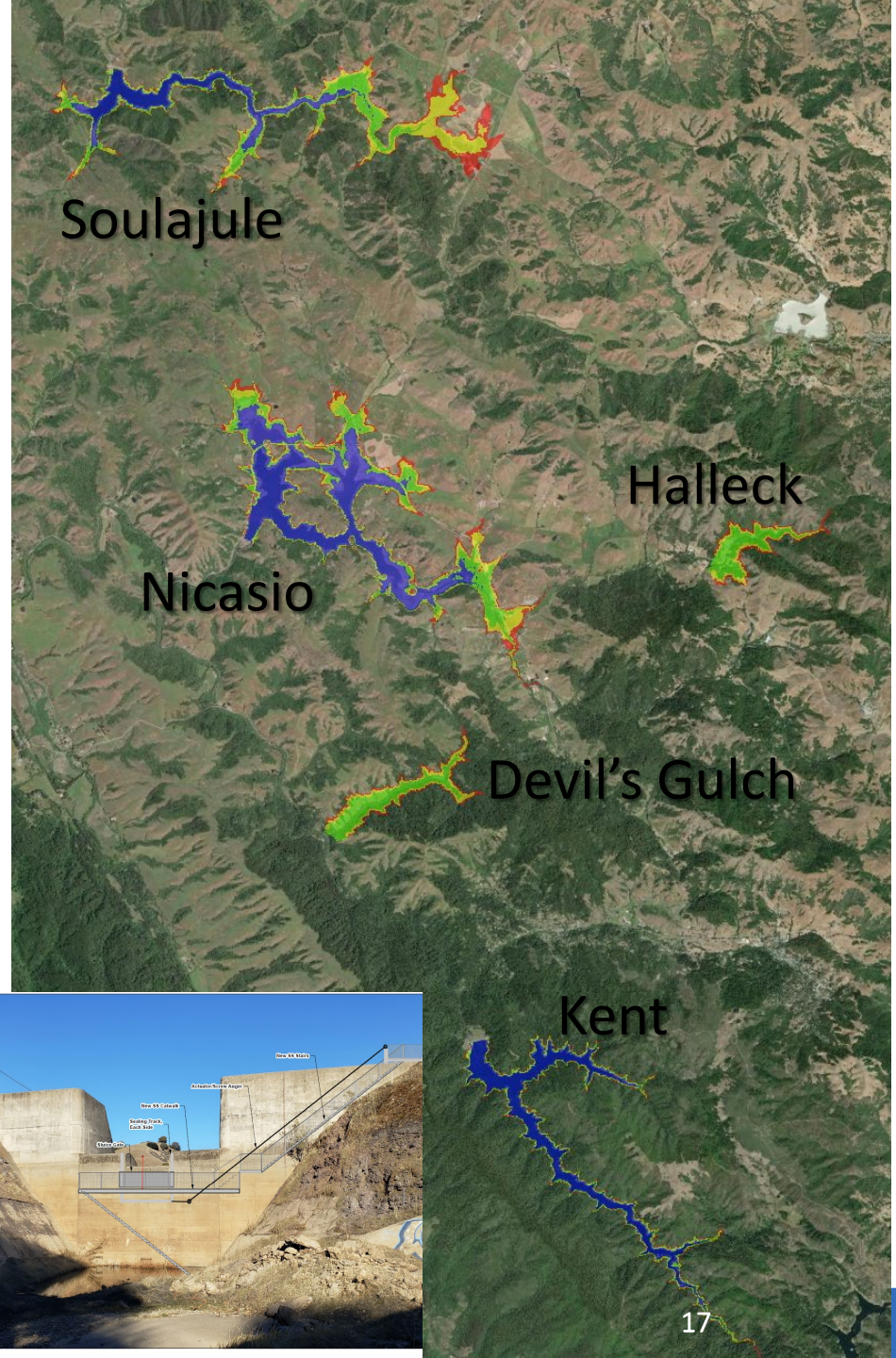


Sonoma-Marin Partnership Options Yield and Cost Summary

Option	Potential New Supply (AFY)	Capital Cost ($M)	Annual O&M Cost ($M)	Cost Range Estimate ($/AF)
1. Maximize Sonoma Water Supply (Existing Facilities)	**1,500**			**$1,300**
2. Maximize Sonoma Water Supply (Resolve Existing Conveyance Bottlenecks)	**2,500**	$16-50	$3	**$2,100 – 2,900**
3. Maximize Sonoma Water (Dedicated Conveyance to Storage)	**4,000**	$60 - 90	$3 - 5	**$2,700 – 3,000**
4. Sonoma Groundwater Well Rehab	**2,000**	$3	$3	**$1,400 – 1,600**
5. Regional Groundwater Bank	**2,500**	$10	$3-4	**$1,500 - 2,000**

Local Storage Augmentation

1. Local Surface Storage Enlargement
2. New Surface Storage
3. Adjustable Spillway Gates

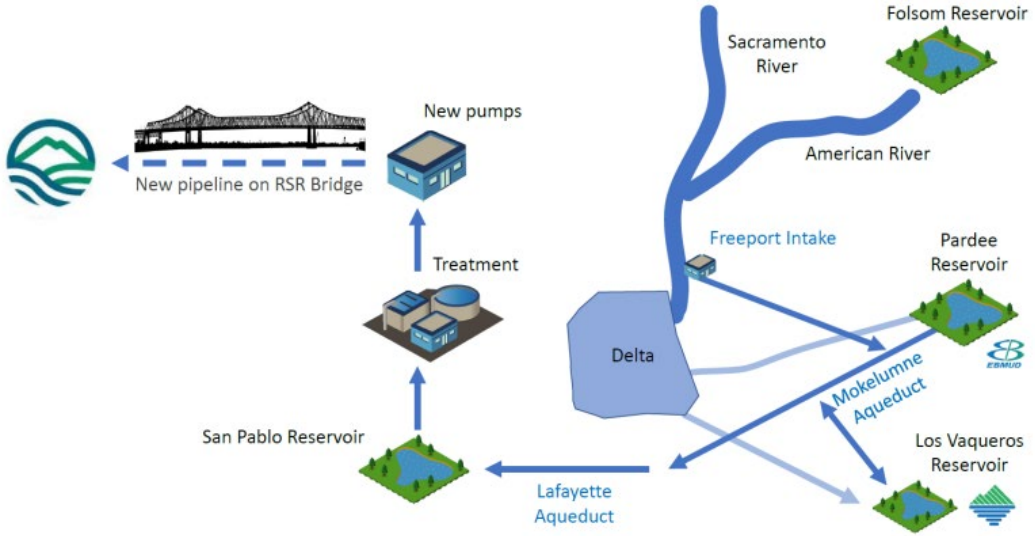


Local Surface Storage Options Yield and Cost Summary

Option	Potential New Supply (AFY)	Capital Cost ($M)	Annual O&M Cost ($M)	Cost Range Estimate ($/AF)
1. Surface Storage Enlargement (20 TAF @ Soulajule, Nicasio, or Kent)	**5,000**	$105 – 170	$3	**$1,700 – 2,400**
2. New Surface Storage (10 TAF @ Devil's Gulch or Halleck)	**2,500**	$200 - $300	$3	**$4,100 – 6,100**
3. Adjustable Spillway Gates (Kent, Nicasio, Soulajule, and Alpine)	**1,300**	$20-40	$1	**$1600 – 2,300**

Water Purchases with Conveyance through Bay Interties

1. EBMUD Intertie (Sac Valley purchases)
2. CCWD Intertie (Sac Valley purchases)
3. North Bay Aqueduct Intertie (Sac Valley purchases)
4. SFPUC Intertie (Golden Gate Bridge)



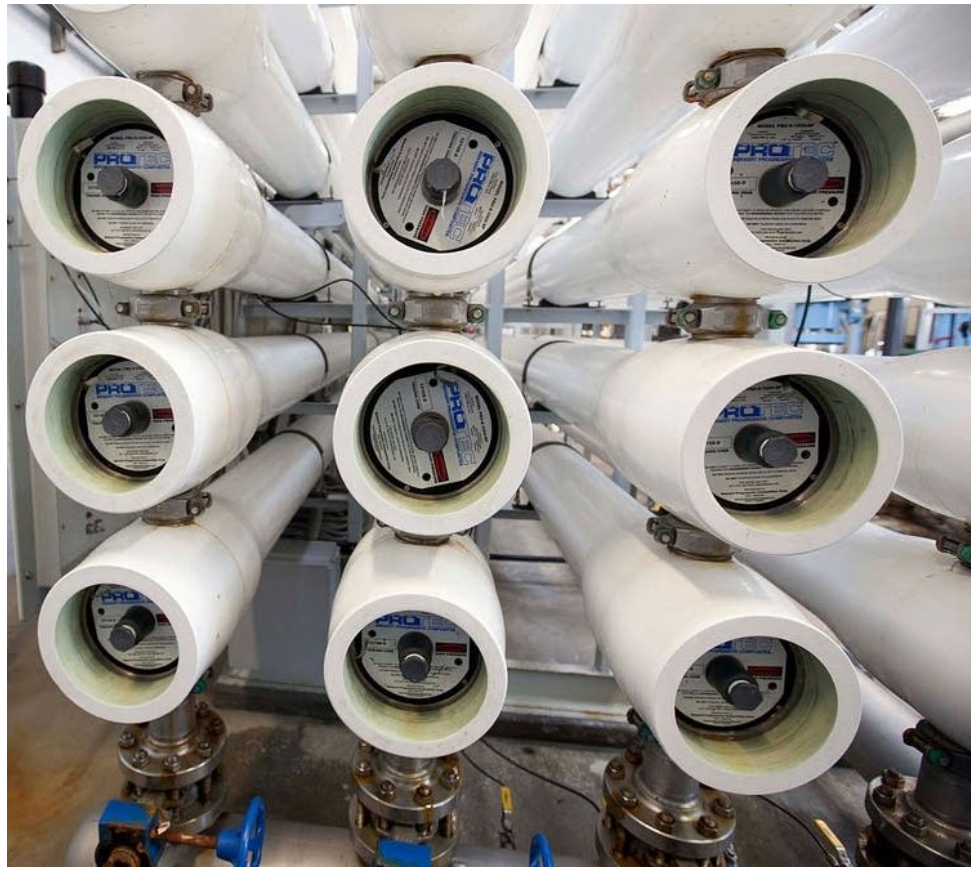
Water Purchases with Conveyance through Bay Intertie Options Yield and Cost Summary

Option	Potential New Supply (AFY)	Capital Cost ($M)	Annual O&M Cost ($M)	Cost Range Estimate ($/AF)
1. EBMUD Intertie	**5,000**	$111	$7-9	**$2,600 – 2,900**
2. CCWD Intertie	**5,000**	$280	$7-9	**$4,300 – 4,600**
3. North Bay Aqueduct Intertie	**5,000**	$346 – 410	$6-8	**$4,800 – 5,800**
4. SFPUC Intertie	**1,000**	$31	$1-2	**$2,900 – 3,200**

* EBMUD, CCWD, and NBA interties assume a maximum of 20,000 AF of Temporary transfer supplied over 4-year dry period

Desalination

1. Marin Regional Desalination Facility
2. Containerized Desalination Facility
3. Bay Area Regional Desalination Facility
4. Petaluma Brackish Desalination Facility



Desalination Options Yield and Cost Summary

Option	Potential New Supply (AFY)	Capital Cost ($M)	Annual O&M Cost ($M)	Cost Range Estimate ($/AF)
1. Marin Regional Desalination Facility				
5 MGD (stand alone)	**5,600**	$234 - 260	$12- 13	**$4,200 – 4,600**
5 MGD (expandable)	**5,600**	$246 - 274	$12- 13	**$4,400 – 4,900**
10 MGD (expandable)	**11,200**	$320 - 331	$20 – 22	**$3,300 – 3,400**
15 MGD	**16,800**	$373 - 401	$28 – 29	**$2,800 – 2,900**
2. Containerized Desalination Facility (5.4 MGD)	**6,050**	$121 - 132	$12 – 13	**$2,700 – 2,900**
3. Bay Area Regional Desalination Facility (5 MGD)	**5,600**	$253 – 268	$5 - 6	**$3,300 – 3,800**
4. Petaluma Brackish Groundwater Desalination Facility (5 MGD)	**5,600**	$105 – 175	$3 – 4	**$1,500 – 2,500**

Water Reuse

1. Recycled Water – expansion of non-potable reuse systems: Peacock Gap and San Quentin
2. Indirect Potable Reuse (IPR): Advanced treatment, conveyance to Kent Lake
3. Direct Potable Reuse (DPR) - Central Marin Sanitation Agency (CMSA):
   - Raw Water Augmentation – CMSA to Bon Tempe Lake
   - Treated Water Augmentation - CMSA to distribution system
4. Direct Potable Reuse (DPR) - Regional
   - Raw Water Augmentation – CMSA, Las Gallinas Valley, SASM to Bon Tempe Lake

Water Reuse Options Yield and Cost Summary

Option	Potential New Supply (AFY)	Capital Cost ($M)	Annual O&M Cost ($M)	Cost Range Estimate ($/AF)
1. Recycled Water Expansion				
Peacock Gap	**285**	$22 - 30	$0.2 – 0.3	**$5,000 – 5,600**
San Quentin	**154**	$13 - 15	$0.2	**$3,900 – 4,500**
2. Regional Indirect Potable Reuse (IPR)	**7,300**	$427 - 477	$9 - 11	**$4,200 – 4,800**
3. CMSA Direct Potable Reuse (DPR)				
Raw Water Augmentation	**4,480**	$165 - 183	$9 – 11	**$3,900 – 4,500**
Treated Water Augmentation	**4,480**	$117 - 131	$8 – 10	**$3,200 – 3,600**
4. Regional Direct Potable Reuse (DPR)	**7,300**	$392 – 439	$16 - 19	**$4,900 – 5,600**

Evaluation Process

Evaluation of Water Management Alternatives

- Performance Criteria
  - How well do each of the alternatives resolve system performance challenges during critical dry period?
    - Manage MMWD reservoir storage above 30,000 AF
    - Reduce potential delivery shortages
- Evaluation Criteria
  - How to compare alternatives that have similar levels of “performance”?
- Application Approach
  - How do individual alternatives perform?
  - What combination of alternatives could be considered?
  - What portfolio strategy is most strategic?

Evaluation Criteria - DRAFT

Evaluation Criteria	Description
Cost	Estimate of capital and annual costs.
Timing	Estimate of time required before project could be planned, designed, permitted, and implemented.
Reliability	Reliability of supply during dry periods of need
Environmental	Anticipated impacts on the natural environment
Feasibility	Maturity of the concept and technical ability to implement.
Energy	Estimated change in energy required to implement and operate.
Permitting/Legal	Anticipated permitting and legal challenges
Social	Description of positive or negative socioeconomic effects.
Jurisdiction	Primary jurisdiction for implementation <who other than Marin needs to be engaged>

Next Steps

Work in Progress

- Integration of water management alternatives into decision support model to evaluate operation when integrated into system
- Applying performance and evaluation criteria to water management alternatives
- Structuring of portfolios and roadmap strategies

Strategic Water Supply Assessment: Schedule

- **September 13 – Summary of Water Management Alternatives**
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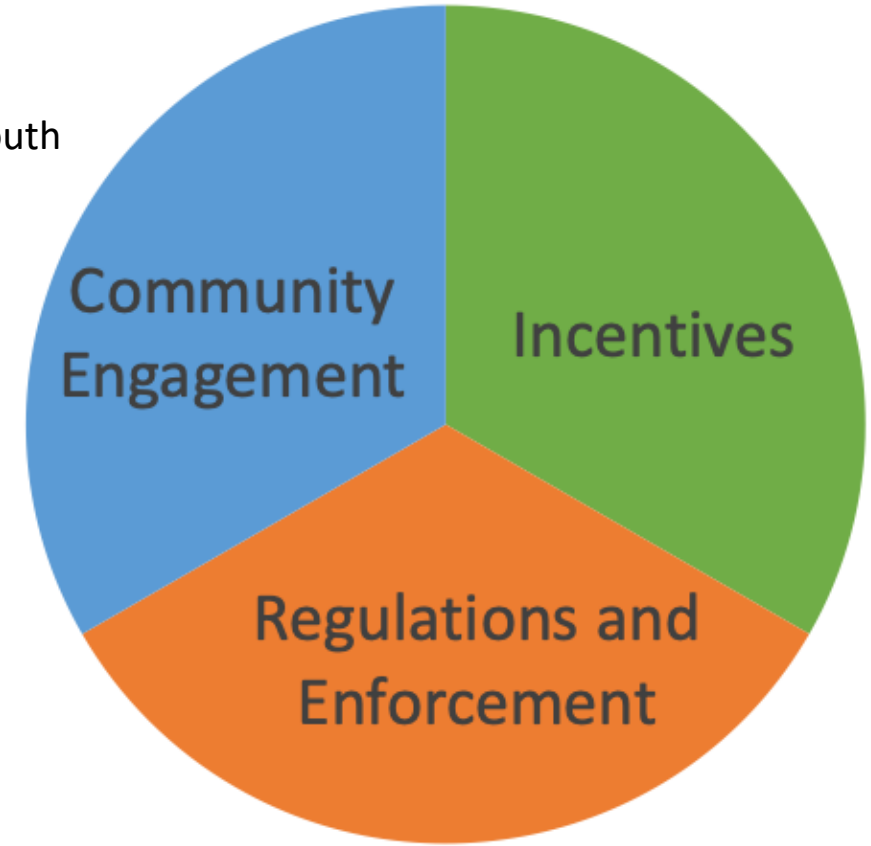
Q & A

Supplemental Information: Summary Descriptions of Water Management Alternatives

Water Conservation

Review: Water Conservation Program

Community Engagement
- Water Education for School Aged Youth
- Educational Webinars
  - Graywater
  - Efficient Irrigation
  - Selecting Appropriate Plants
  - & many others



Incentives
- Quantifiable water savings
- Offerings evolve over time based on new and emerging technologies

Regulations and Enforcement
- State
  - MWELO
  - SB407: Limiting toilets flush volume
- Local
  - Graywater Ordinance
  - Water Efficient Landscape Ordinance

SWSA: Water Conservation Project Alternatives

Option 1. Water Conservation Project

Option 2. Regulatory Driven Project

- Builds on the savings projected from Option 1

Option 1: Water Conservation Project Summary

- 2045 Adjusted Water Use
  - 2045 demands: 27,427acft, 15% reduction in projected demands
    - **106 GPCD**
    - **73 R-GPCD**
- Cumulative Savings in 2045: 22,515 acft
- UPDATED Cost to Fund Conservation as Supply
  - District Cost: $1,792/acft
    - Annual Budget Estimate: $1.7M for incentives and associated program management
      - Does not include School Education Program and other non-incentive based program expenditures
  - Customer Cost: $2,883/acft
    - Estimated hardware, installation, and maintenance costs for each incentivized program

Option 1: Water Conservation Project

	Water Conservation Project (Annual Participation)	Past Annual Participation	
		Pre-Drought	2021 Drought
AMI Leak Letter Notifications (/yr)	1,250	1,140	1,601
Non-Functional Turf Conversion (sqft/yr)	70,000	0	0
Turf Conversion (sqft/yr)	100,000	7,736	410,000
Pool Covers (/yr)	90	12	399
SMART Irrigation Controllers (/yr)	100	50	480
Conservation Assistance Program (/yr)	500	195	667
Laundry to Landscape Graywater Kits (/yr)	40	5	44
Rain Barrels (gallons/yr)	15,000	460	43,497

Option 2: Regulatory Driven Project

- Regulatory Driven Project builds on the savings projected in Option 1: Water Conservation Project
- Water Savings Estimate resulting from adoption of strict landscape codes and associated enforcement:
  - 2045 demands: 25,875 acft
    - **100 GPCD (vs 106 GPCD)**
    - **69 R-GPCD (vs 73 GPCD)**
- Cost to Fund a Regulatory Driven Project
  - District Cost: ~$4,000/acft
  - Customer Cost: ~$3,700/acft

Option 2: Regulatory Driven Project

Regulations and Enforcement would need to be developed and would require:

- Enforcement of water budgets and penalties
- Expanded Water Efficient Landscape Ordinance regulations
  - Limit turf installations in all new development and remodels
  - Only allow low water use plants, drip irrigation in all new development and remodels
  - Prohibit non-functional turf in existing non-residential sites
  - Prohibit turf in front yards and limit allowable turf area in existing single-family homes
- Indoor fixture standards/requirements
- Retrofit on Resale and/or Change of Customer
  - Ensure fixture, landscape, and irrigation requirements are met.
- Consider community impact of deeper demand reductions particularly to landscapes and the non-residential sector.

SWSA: Water Conservation Considerations

- Difficult to forecast savings
- Consequences of missing target
- Uncertainty in incentives alone to drive public participation and behavior change

	Option 1: Water Conservation Project	Option 2: Regulatory Driven Project
2030 Yield, AF	1,604	2,027
2045 Yield, AF	4,009	5,561
Average Yield, AF	938	1,246
Cumulative Yield, AF	22,515	29,913

Alternative	**Option 1: Water Conservation Project**	**Option 2: Regulatory Driven Project**
Capital Cost	$0	$0
Annual O&M Costs	$1,680,000	$4,980,000
Total Annualized Cost	$1,680,000	$4,980,000
2045 Yield, AF	4,009	5,561
Cost per AFY	$1,792	$4,000

Sonoma-Marin Partnerships

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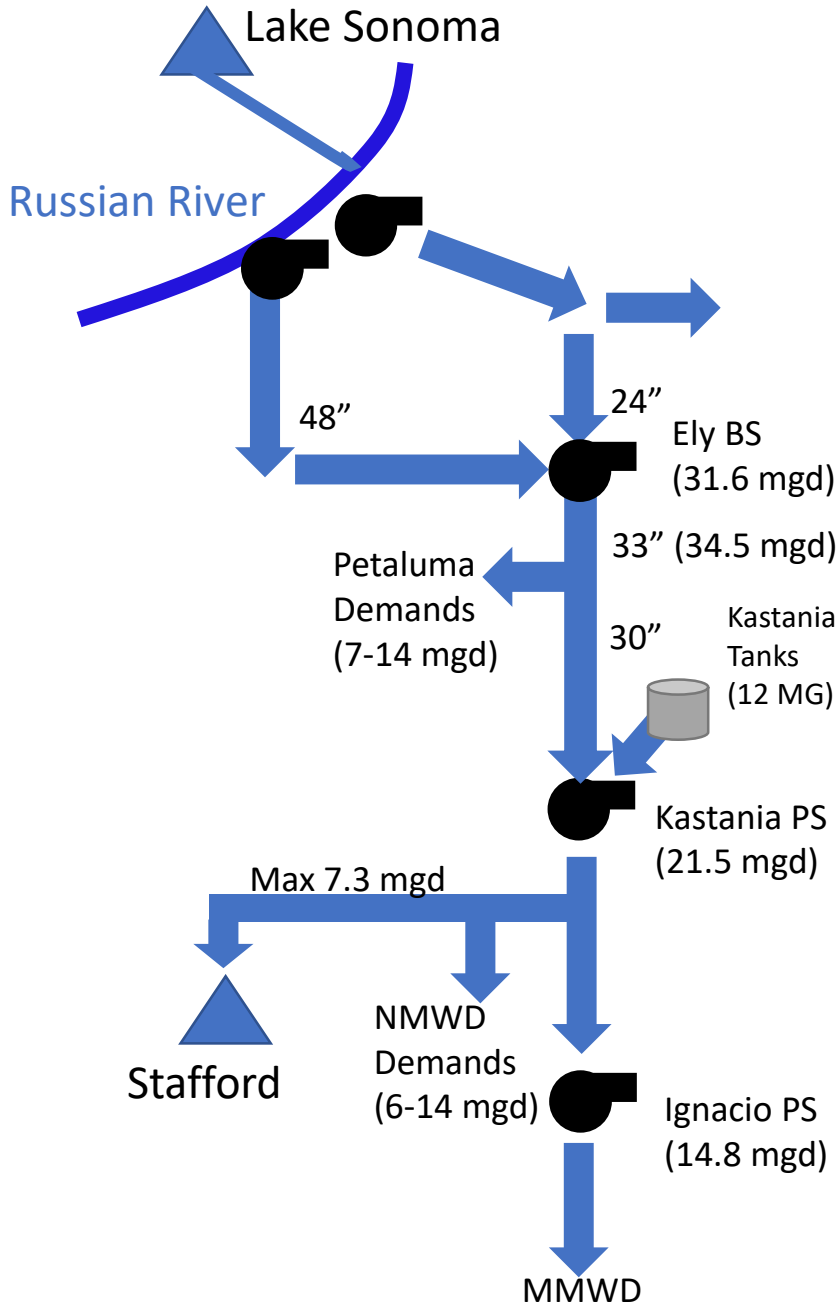
1. Maximize Use of Sonoma Water (Existing Facilities)
2. Maximize Use of Sonoma Water (Resolve Conveyance Bottlenecks)
3. Maximize use of Sonoma Water (Dedicated Conveyance to Nicasio Reservoir)
4. Groundwater Well Rehabilitation
5. Regional Groundwater Bank

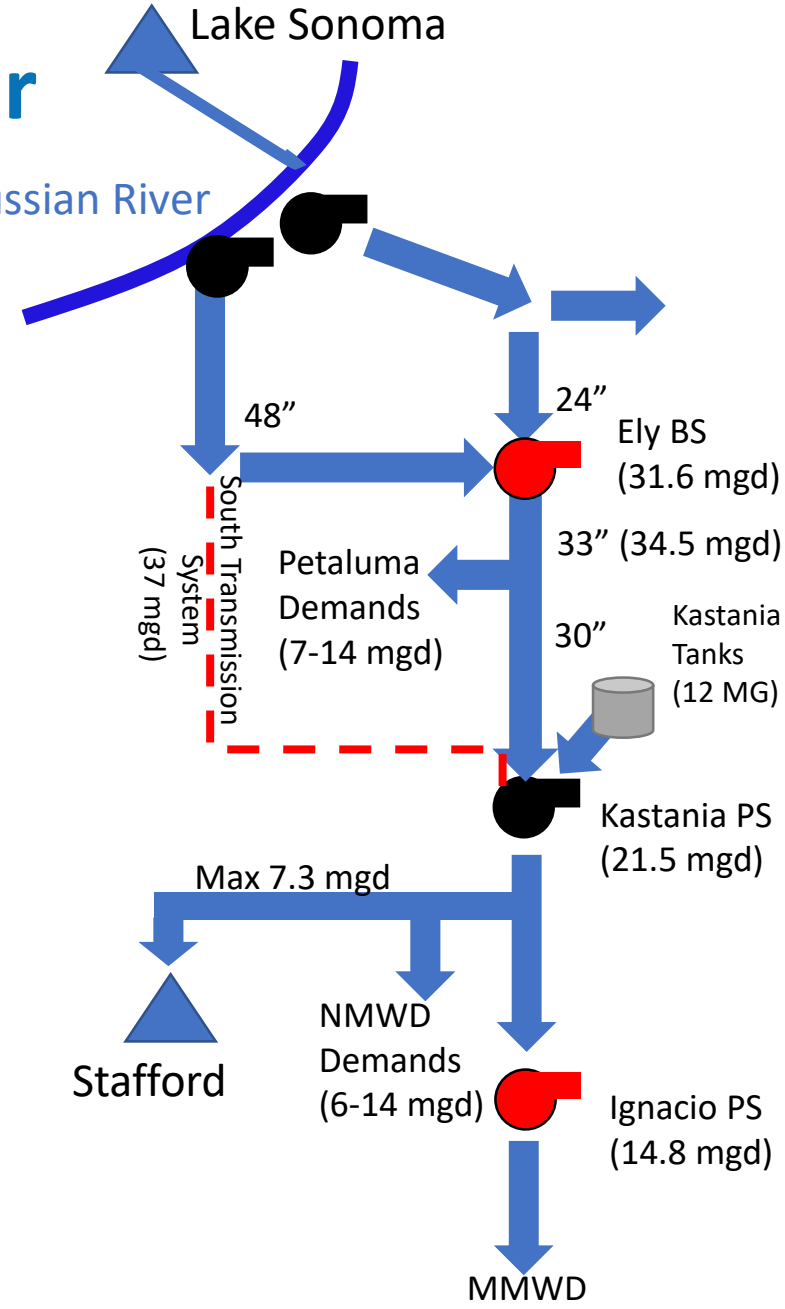
Option 1: Maximize Use of Sonoma Water (Existing Facilities)

- Operate to Maximize Use of Russian River Water
  - Maximize use in Winter
  - Maximize take of Sonoma Water up to contractual amount 14,300 AFY (12.8 mgd)
  - Reduce use of MMWD local reservoir water supply
- Existing Conveyance Limitations
  - Ely Booster (31.6 mgd) and shared 33” section of the Petaluma aqueduct with Petaluma and North Marin
  - Kastania Pump Station (21.5 mgd) Improvements and Ignacio Pump Stations (14.8 mgd)
  - After Petaluma aqueduct, bottleneck becomes Ignacio Pump Station (14.8 mgd) and MMWD winter demands
- Integrated Reservoir Operational Strategy
  - Optimize the balance of MMWD reservoir and Sonoma Water supplies dependent on hydrology, storage conditions, and demand



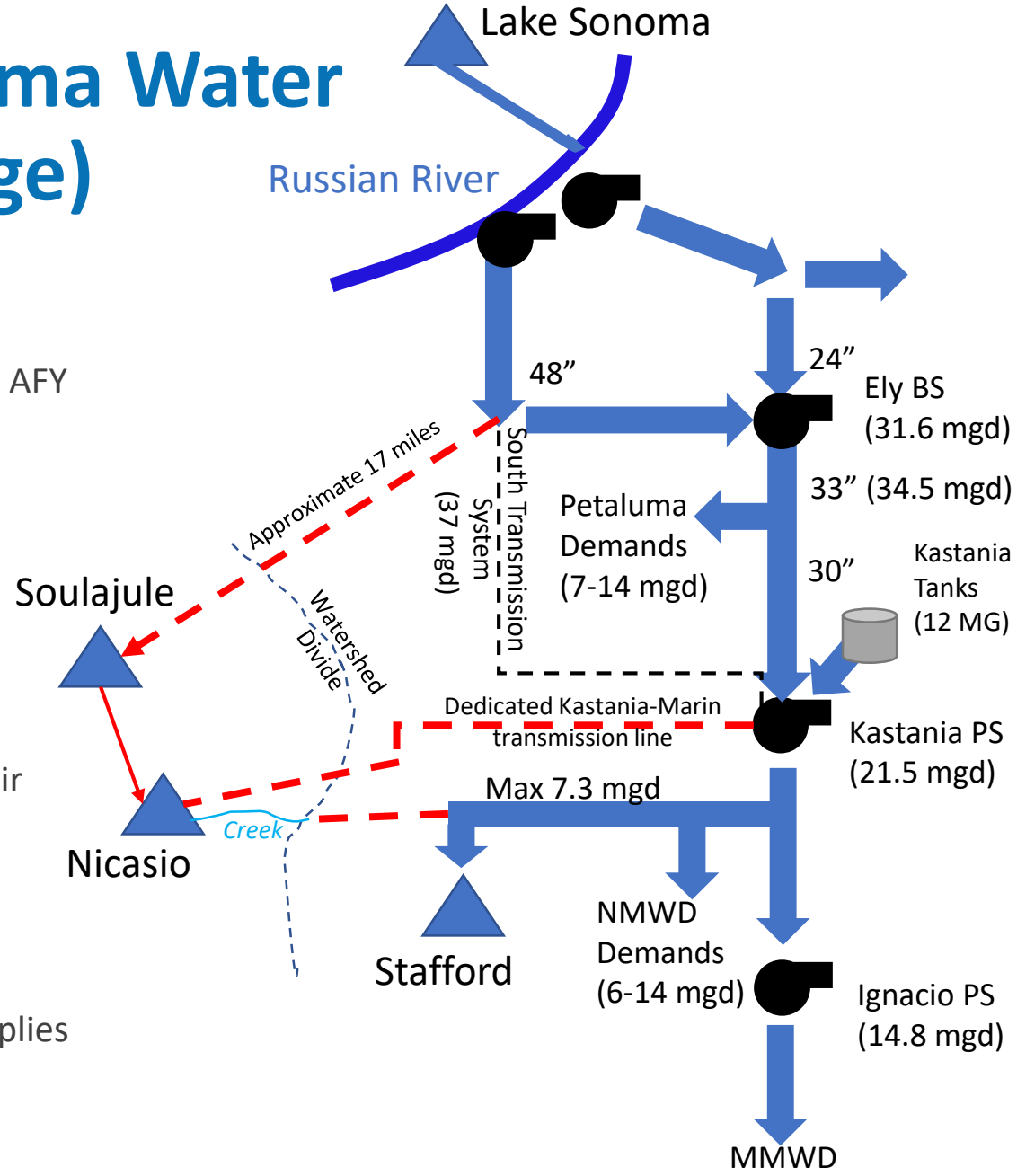
Option 2: Maximize Use of Sonoma Water (Resolve Conveyance Bottlenecks)

- Operate to Maximize Use of Russian River Water
  - Maximize use in Winter
  - Maximize take of Sonoma Water up to contractual amount 14,300 AFY (12.8 mgd)
  - Reduce use of MMWD local reservoir water supply
- Resolve Conveyance Limitations
  - Remove Petaluma Aqueduct limitations
  - Implement Petaluma aqueduct conveyance measures: South Transmission System (STS) or Petaluma Aqueduct (Ely BS)
  - Increase capacity of Ignacio Pump Station
- Integrated Reservoir Operational Strategy
  - Optimize the balance of MMWD reservoir and Sonoma Water supplies dependent on hydrology, storage conditions, and demand



Option 3: Maximize Use of Sonoma Water (Dedicated Conveyance to Storage)

- Operate to Maximize Use of Russian River Water
  - Maximize use in Winter
  - Maximize take of Sonoma Water up to contractual amount 14,300 AFY (12.8 mgd)
  - Reduce use of MMWD local reservoir water supply
- Dedicated Conveyance to Storage
  - Extend Lake Stafford pipeline to watershed divide for delivery to Nicasio
  - New conveyance from Kastania to Nicasio Reservoir
  - New dedicated conveyance from Cotati tanks to Soulajule Reservoir
  - Electrify Soulajule to move water to Nicasio more reliably
  - Implement South Transmission System (STS)
- Integrated Reservoir Operational Strategy
  - Optimize the balance of MMWD reservoir and Sonoma Water supplies dependent on hydrology, storage conditions, and demand

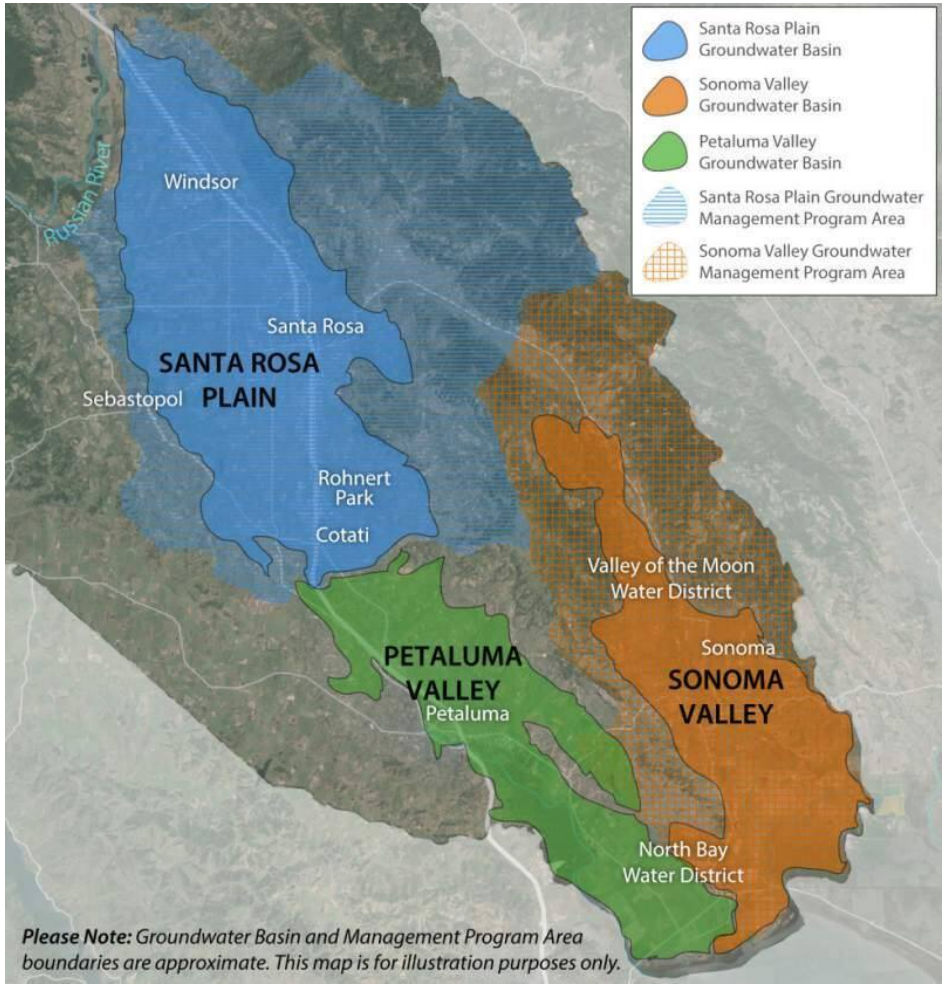


Option 4: Groundwater Well Rehabilitation

- Sonoma Water operates groundwater production wells in the San Rosa Plain
- Wells have not been activated in recent years
- Rehabilitation of wells is underway (5.5 mgd or ~6,000 AFY)
  - Todd Road Well (1.4 mgd)
  - Sebastopol Road Well (2.1 mgd)
  - Occidental Road Well (2.0 mgd)
- Increasing production will provide more reliable delivery to MMWD
- Assume that MMWD is a 1/3 participant in project (yield and cost)

Option 5: Regional Groundwater Bank

- Potential Regional Groundwater Bank
  - Santa Rosa Plain
  - Sonoma Valley
  - Petaluma Valley
- Facilities
  - ASR Wells in Each Basin
  - Connections to aqueduct
  - Treatment?
- Water Storage Operation
  - Put: Winter or Recycled Water
  - Storage: Participant Pools + contribution to basin
  - Take: Drought year pumping
- Delivery
  - Direct delivery or in-lieu exchanges
- Assumptions
  - 20,000 AF of storage capacity developed
  - 5,000 AFY of dry year take from bank
  - Assume MMWD is a 50% participant (50% of cost and yield)
- Considerations
  - Groundwater Sustainability Agencies (GSAs) developing Plans
  - Alignment with benefits for overlying pumpers
  - Exchange agreements and accounting systems
  - **A lot of unknowns, need further investigation to estimate yield**



Local Storage Augmentation

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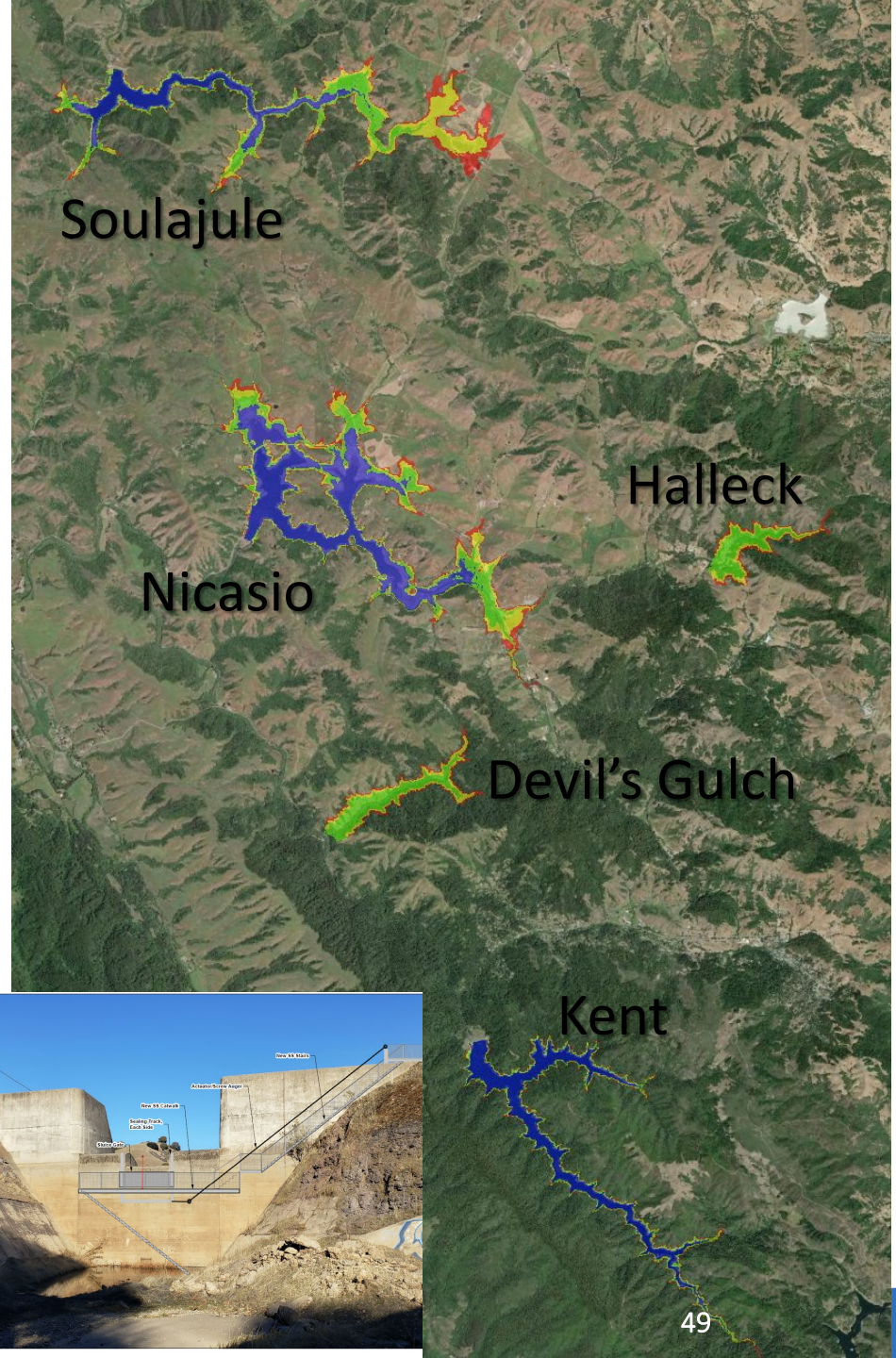

Previous Studied Reservoir Sites

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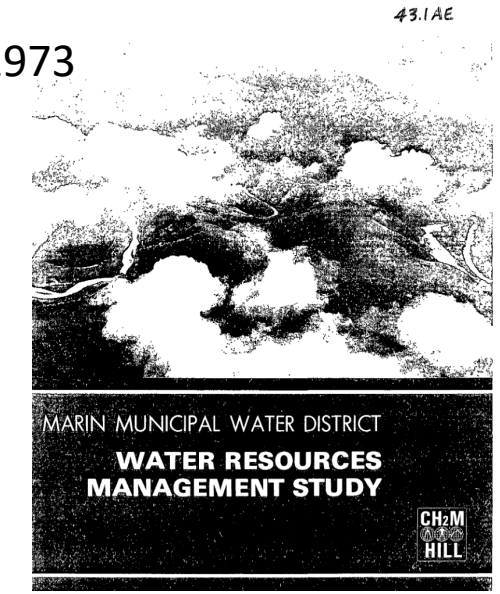
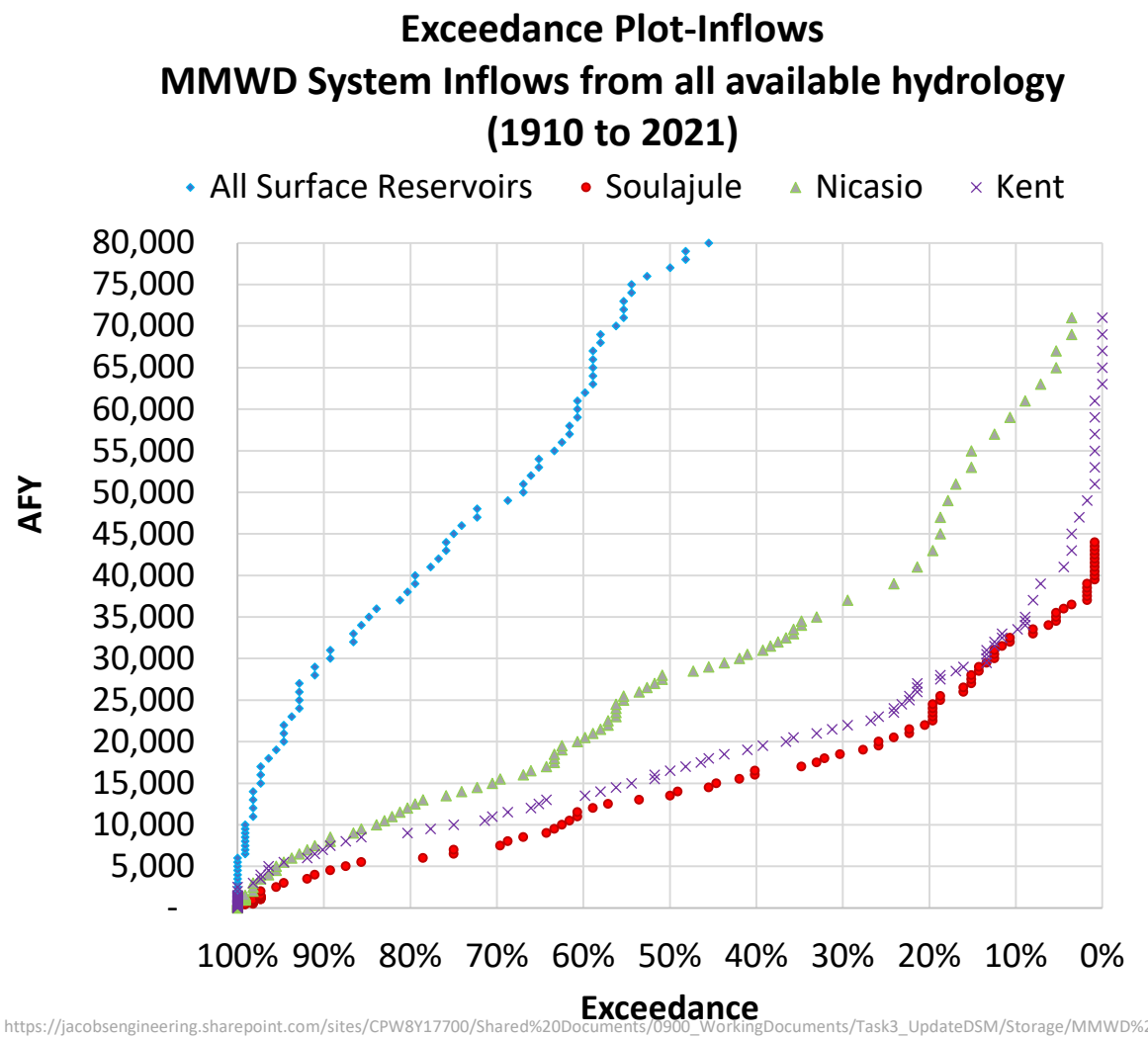


TABLE 5-1
LOCAL WATER SUPPLY PROJECTS

WATER SUPPLY PROJECT	YIELD ACRE-FEET	
Lower Walker Creek	25,000	Severe Environmental Impact
Middle Walker Creek	13,000	Requires new dam, Soulajule was built after this assessment
Upper Walker Creek	10,000	Severe Environmental Impact
Lagunitas Diversion to Nicasio Reservoir	6,000	Diversion downstream from Kent, Kent expanded in 1982
Lagunitas Diversion to Devil's Gulch	9,000	Environmental Impact
San Antonio Creek	7,000	Severe Local Impact
Old Mill Creek	240	Low yield
San Anselmo Creek	1,700	Low yield
Galinas & Miller Creeks	4,700	Low yield, conflict with park project

Reservoir Hydrology and Spills



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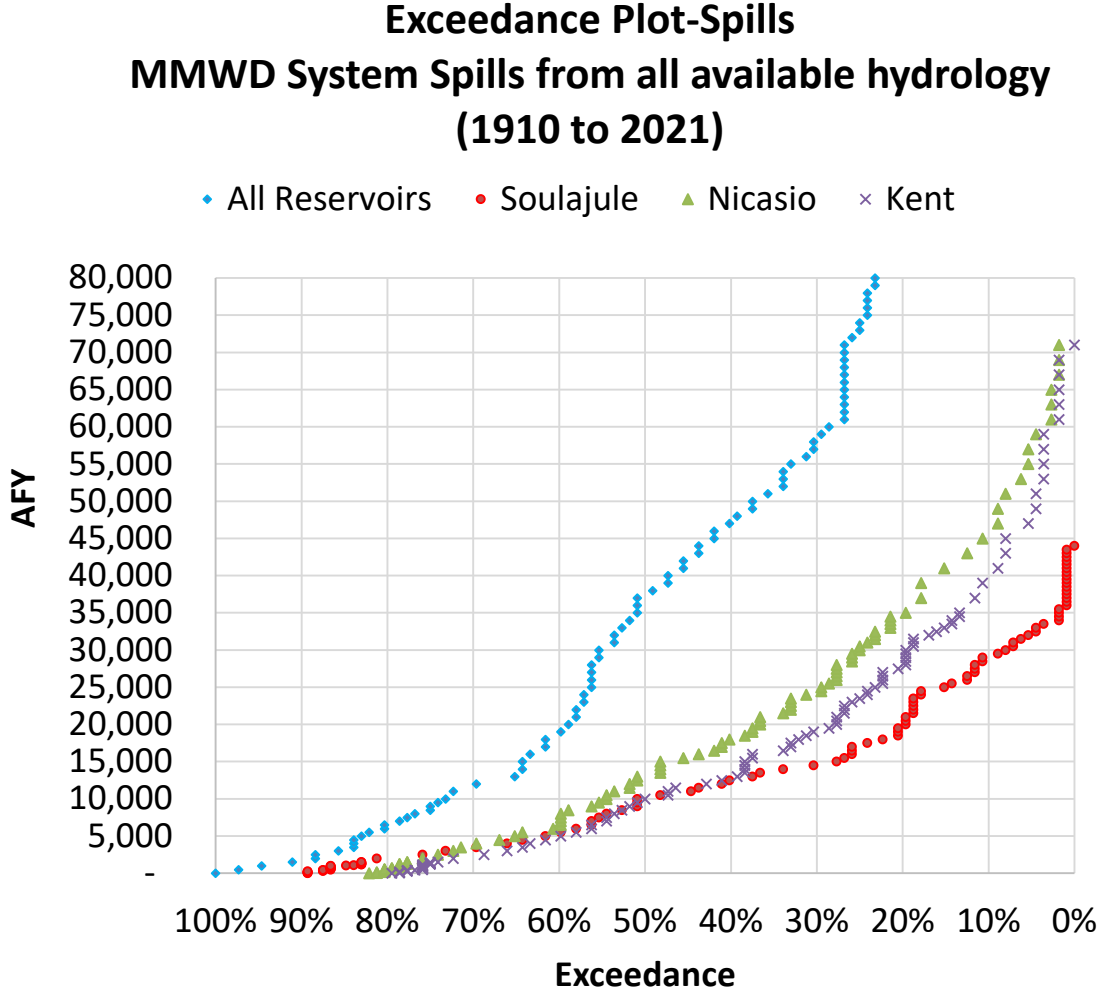

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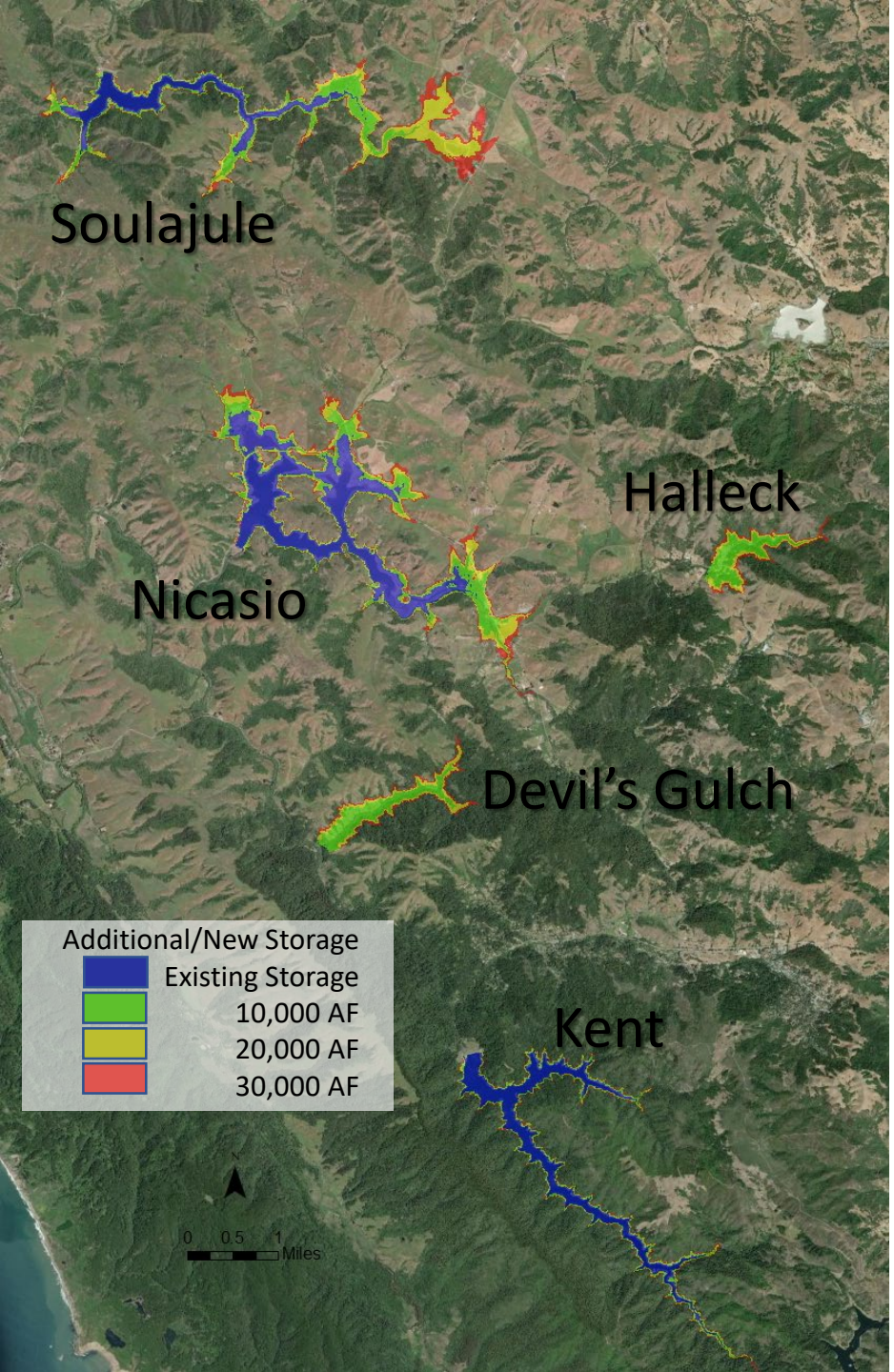
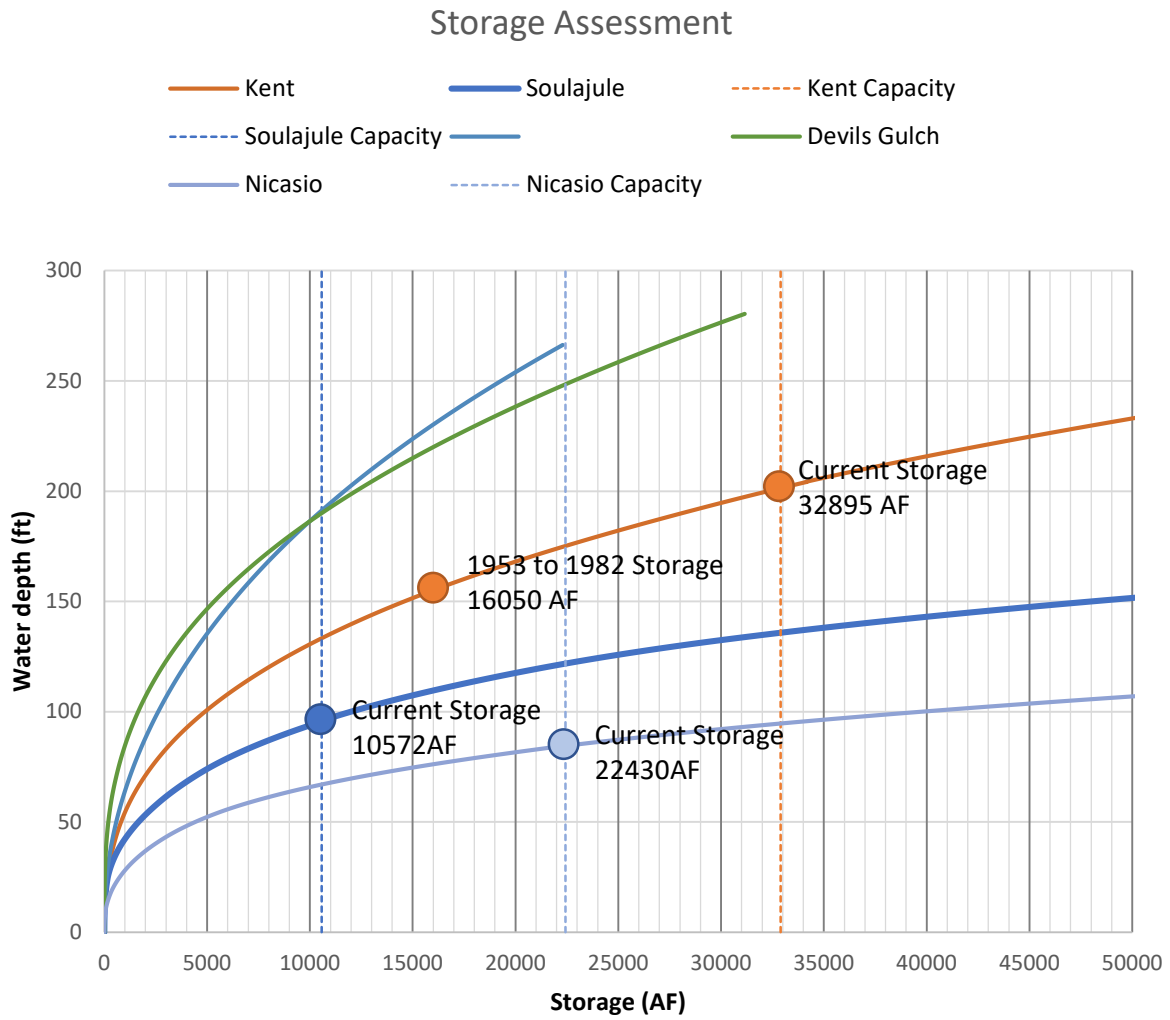
Storage-Capacity and Inundation area





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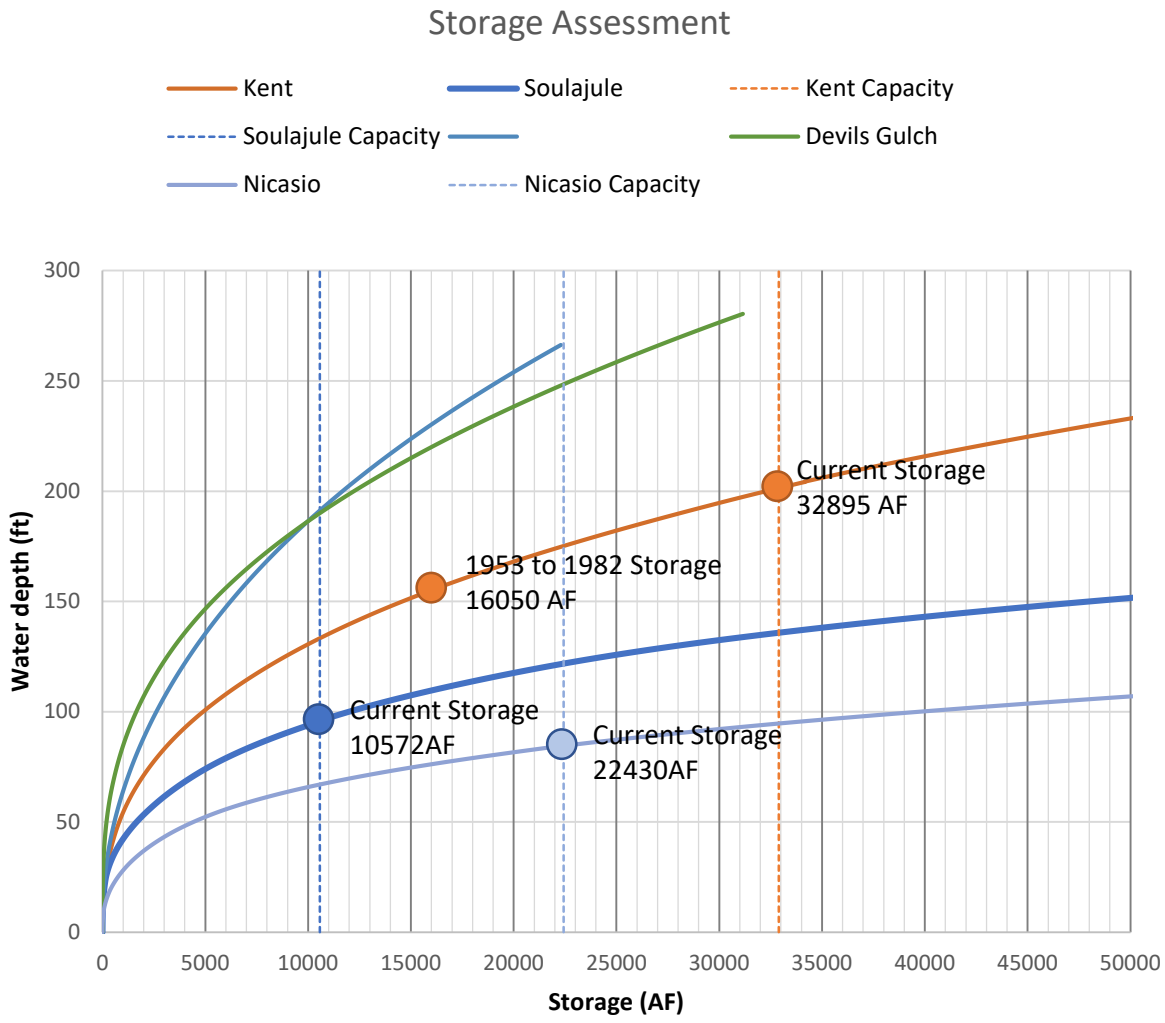

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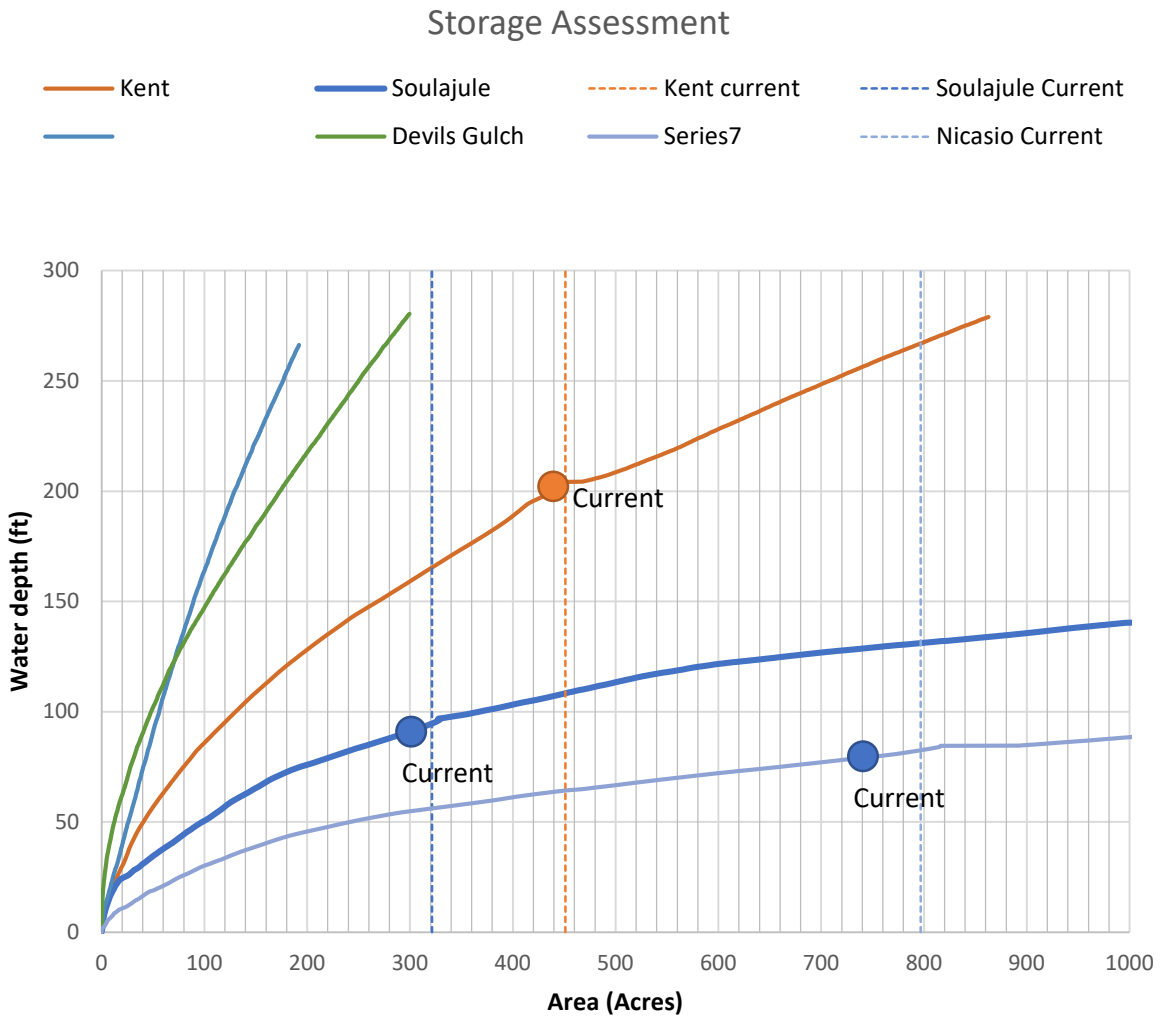

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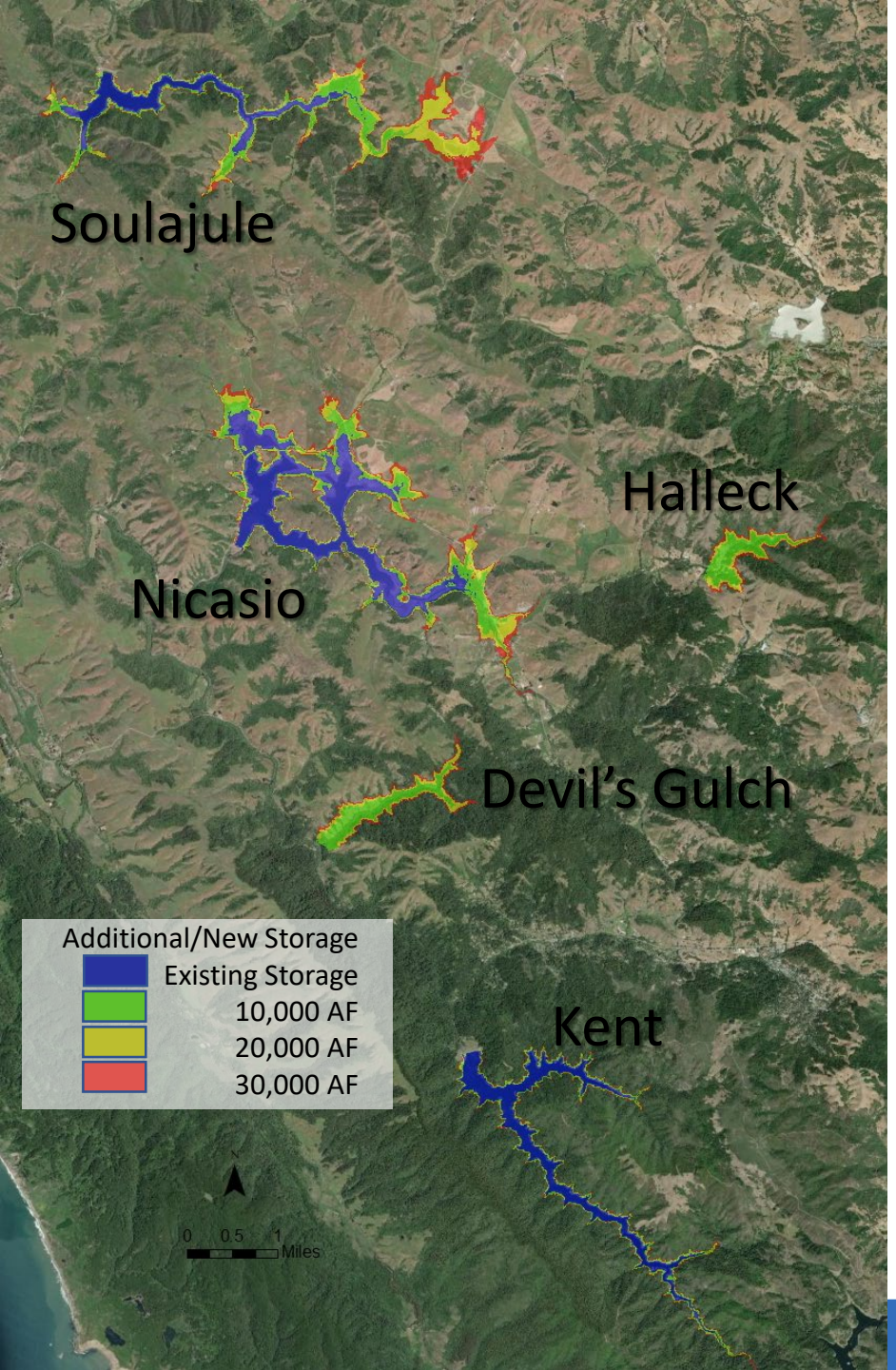


Local Surface Storage Characteristics

Existing Storage Augmentation

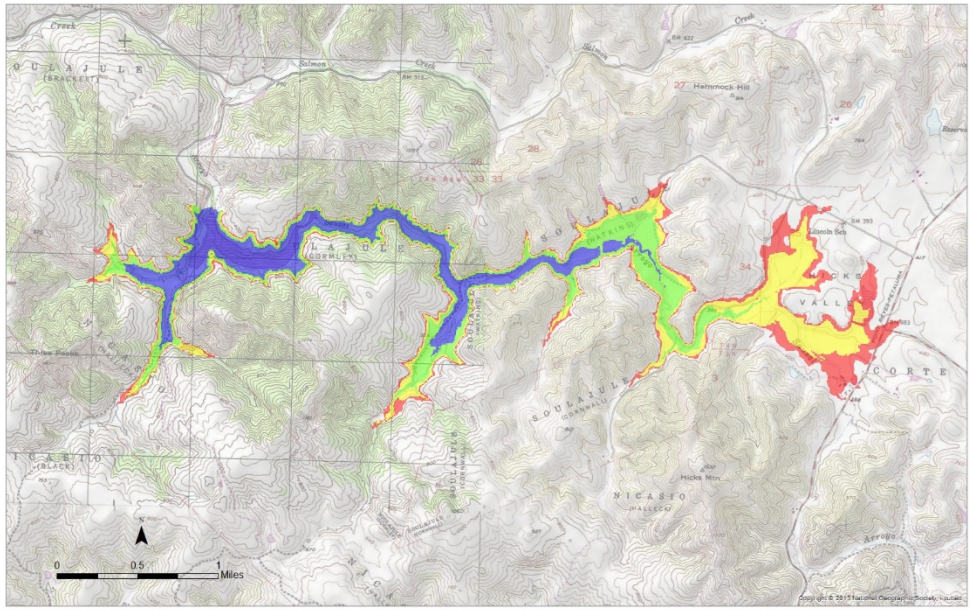
Storage Increase (AF)	Increased Dam Height (ft)			New Inundated Areas (acres)		
	Kent	Soulajule	Nicasio	Kent	Soulajule	Nicasio
10,000	19	24	12	116	236	378
20,000	35	39	19	194	523	630
30,000	50	49	26	268	756	837

Potential New Storage Locations

Storage (AF)	Dam Height (ft)		Inundated Areas (acres)	
	Halleck	Devil's Gulch	Halleck	Devil's Gulch
10,000	186	186	118	154
20,000	254	238	180	232
30,000	303	277	229	293

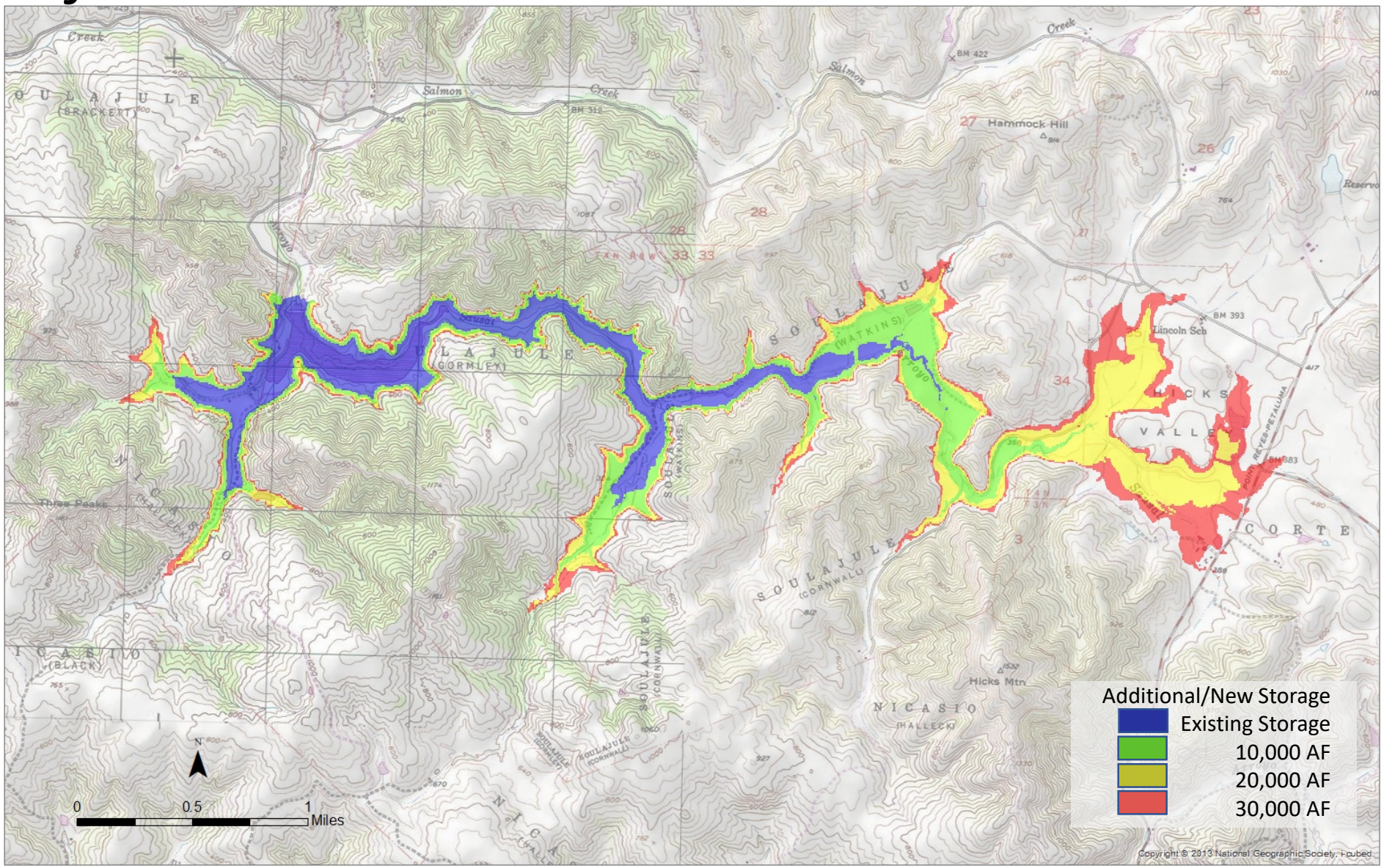
Option 1: Raise Existing Dams

- Updated estimates from Water Resources Plan 2040
- Soulajule Reservoir
  - Increase Soulajule Dam height by 39 feet
  - Additional 20,000 AF of storage
  - Electrification of Soulajule
- Kent Reservoir
  - Increase dam height by 35 feet
  - Additional 20,000 AF of storage
- Nicasio Reservoir
  - Increase dam height by 19 feet
  - Additional 20,000 AF of storage

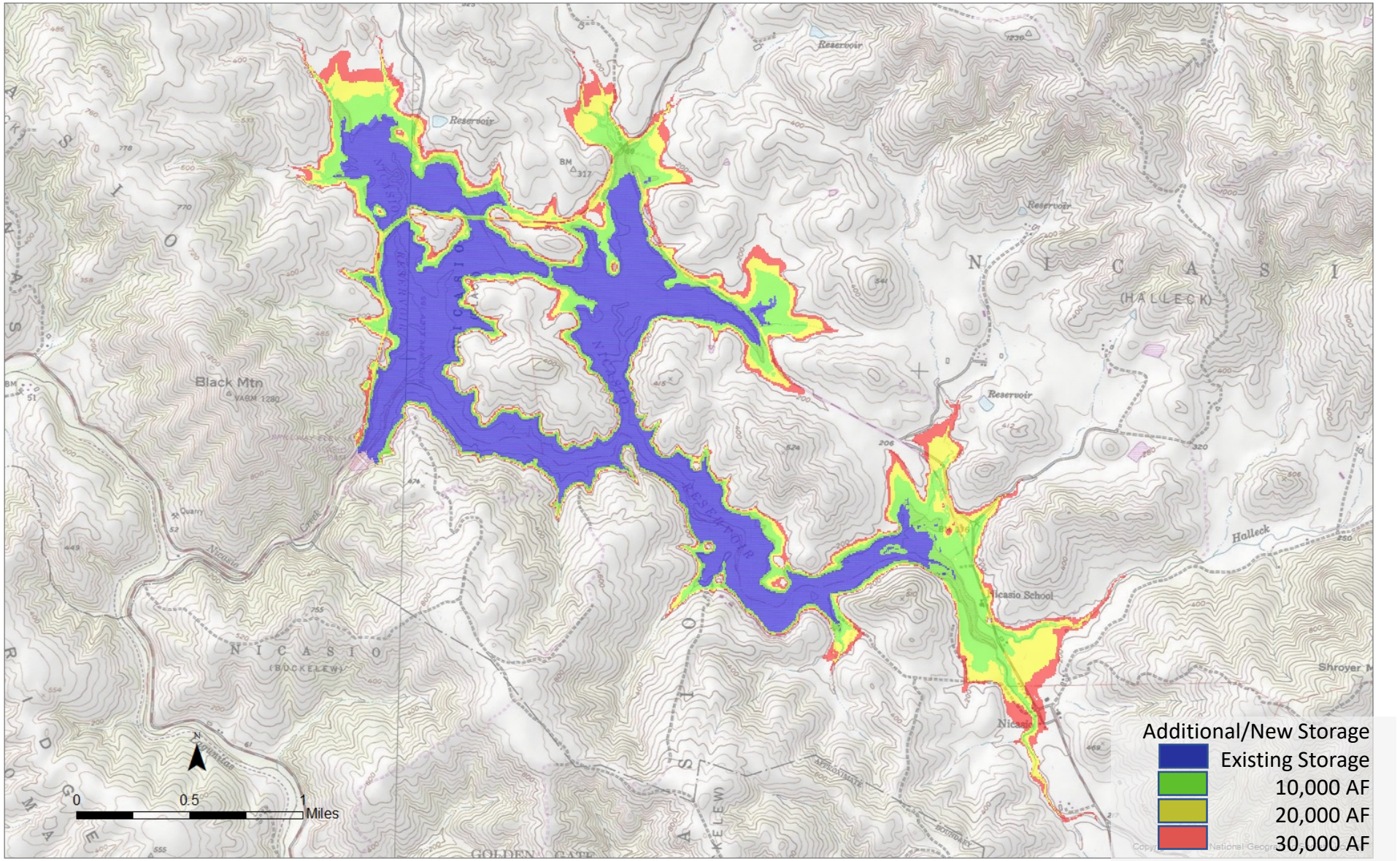


- Considerations
  - Hydrology and spills
  - New inundated areas
  - Dam height
  - Dam adequacy and structural integrity
  - Water rights and environmental concerns

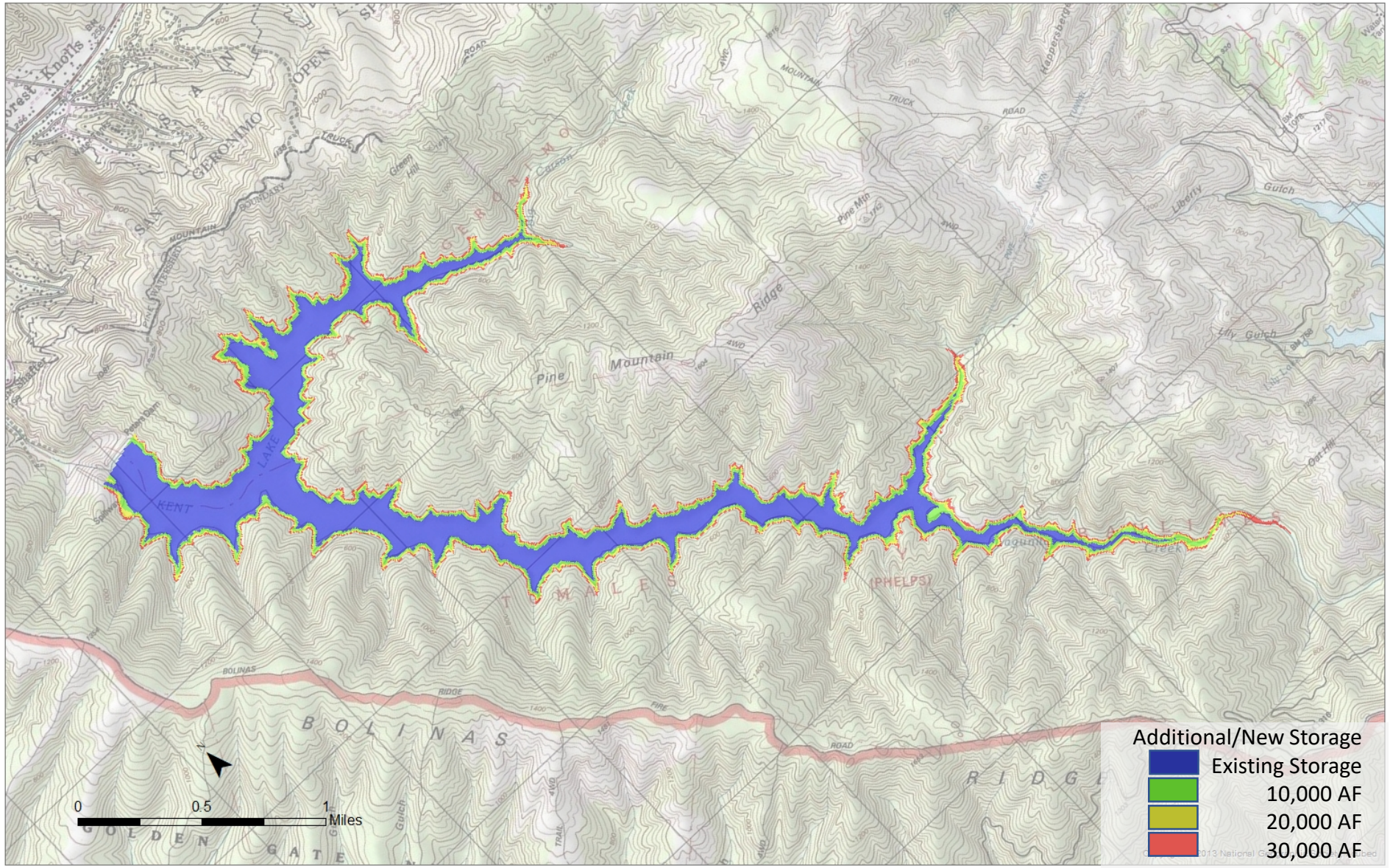
Soulajule Reservoir Characteristics



Nicasio Reservoir Characteristics

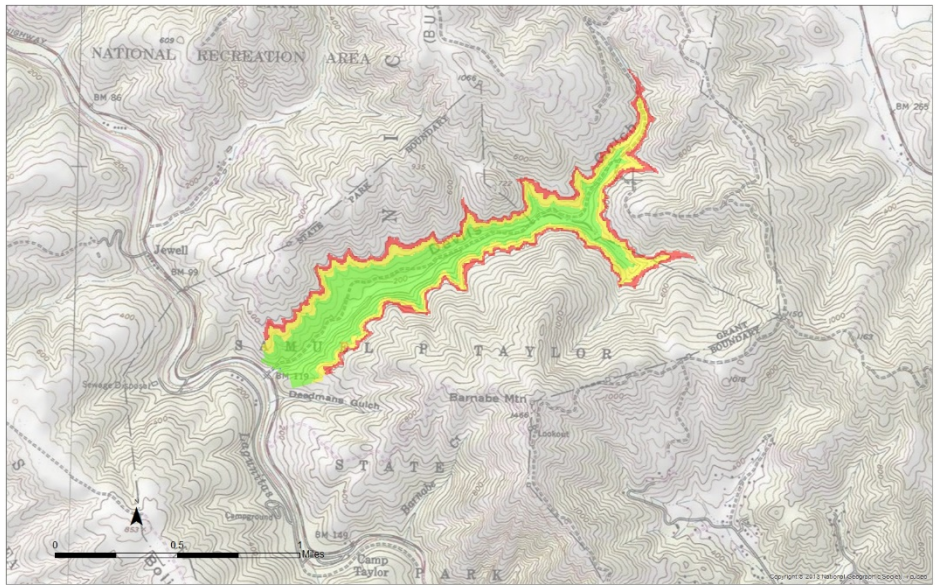


Kent Reservoir Characteristics



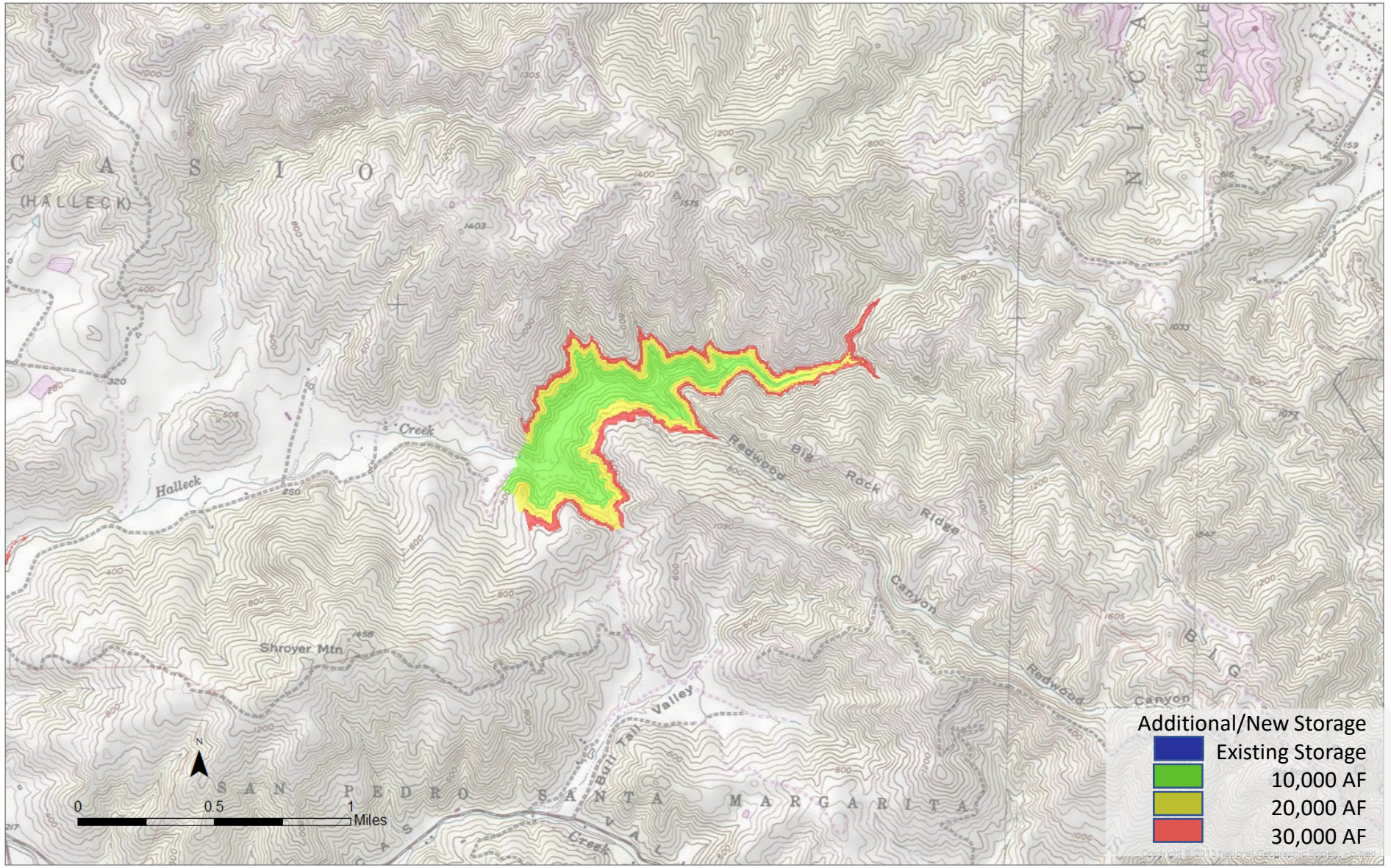
Option 2: New Dams and Reservoirs

- Reviewed past studies
- Identified two representative new locations
- Halleck Reservoir
  - Dams Halleck Creek in Nicasio watershed
  - Over 180 ft dam required to create 10,000 AF of storage; and over 250 ft dam for 20,000 AF
- Devil's Gulch
  - Dams Devil's Gulch in Samuel Taylor State Park
  - Over 180 ft dam required to create 10,000 AF of storage; and about 240 ft dam for 20,000 AF

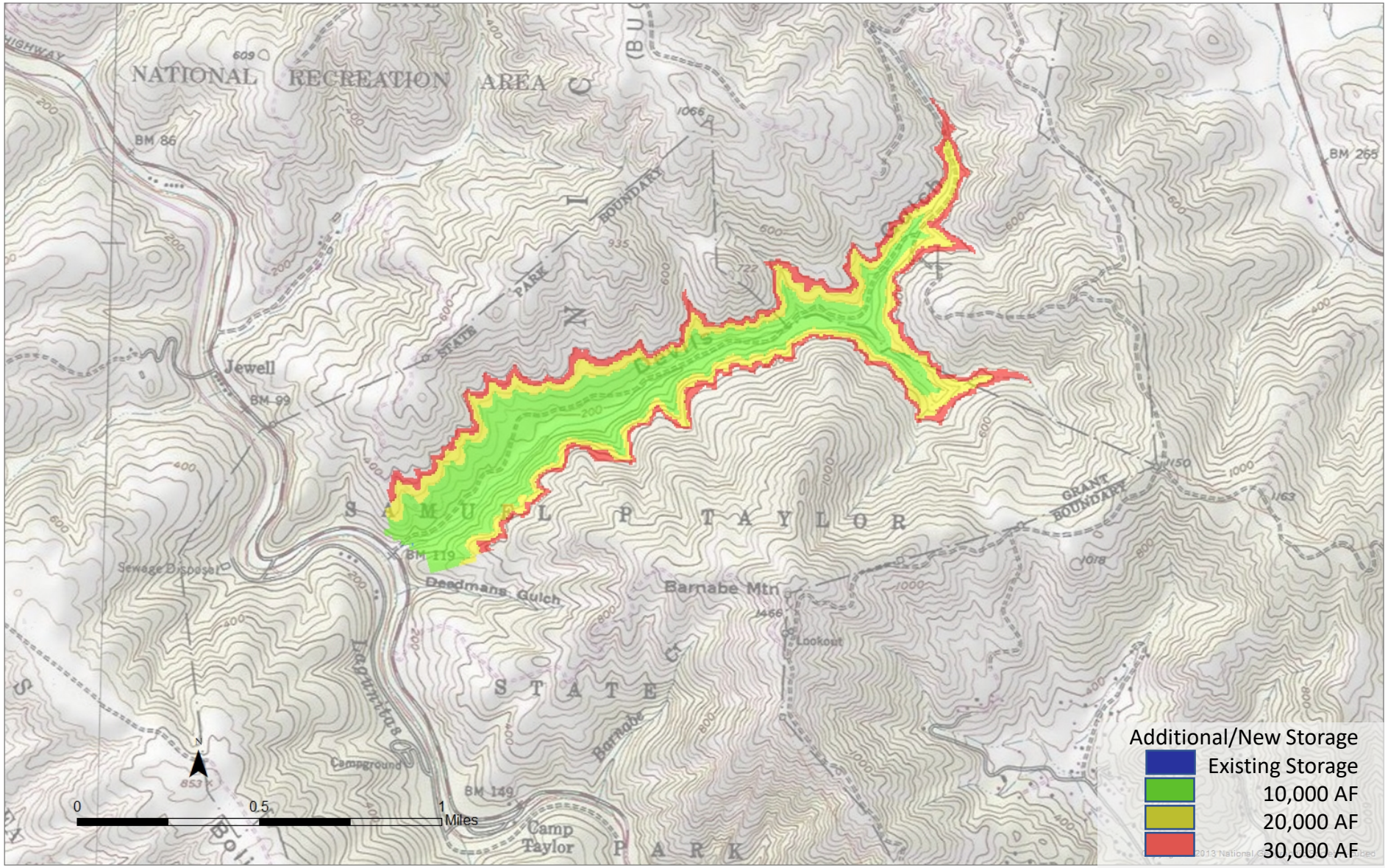


- Considerations
  - Hydrology and spills
  - New inundated areas
  - Dam height
  - Dam adequacy and structural integrity
  - Water rights and environmental concerns

Halleck Reservoir Characteristics



Devil's Gulch Reservoir Characteristics



Option 3: Adjustable Spillway Gates

- Description
  - Increase reservoir storage through installation of adjustable spillway gates
  - Gates to be installed and operated to retain additional storage during wet periods
  - Likely limited to 3 feet of increase (5,270 acre-feet)
- Considerations
  - Adequacy of spillway and dam
  - Increased inundated lake area

Figure 10-2
Stafford Lake Main Spillway Movable Notch Gate
North Marin Water District Local Water Supply

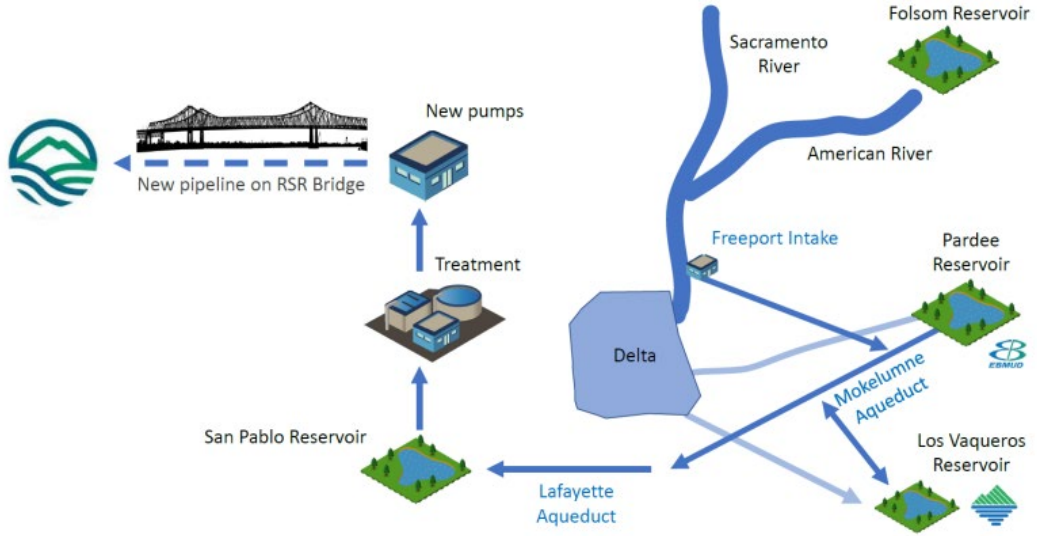
Relative Increase in Storage Capacity with Increase in Spillway Height

Elevation Increase (ft)	Kent Lake (acre-feet)	Nicasio (acre-feet)	Soulajule (acre-feet) (earthen)	Alpine Lake (acre-feet)
1	440	750	300	230
2	880	1520	620	460
3	**1330**	**2310**	**930**	**700**
4	1780	3110	1250	930
5	2240	3920	1580	1180
Current Freeboard	15	15	12	8

Water Purchases with Conveyance through Bay Interties

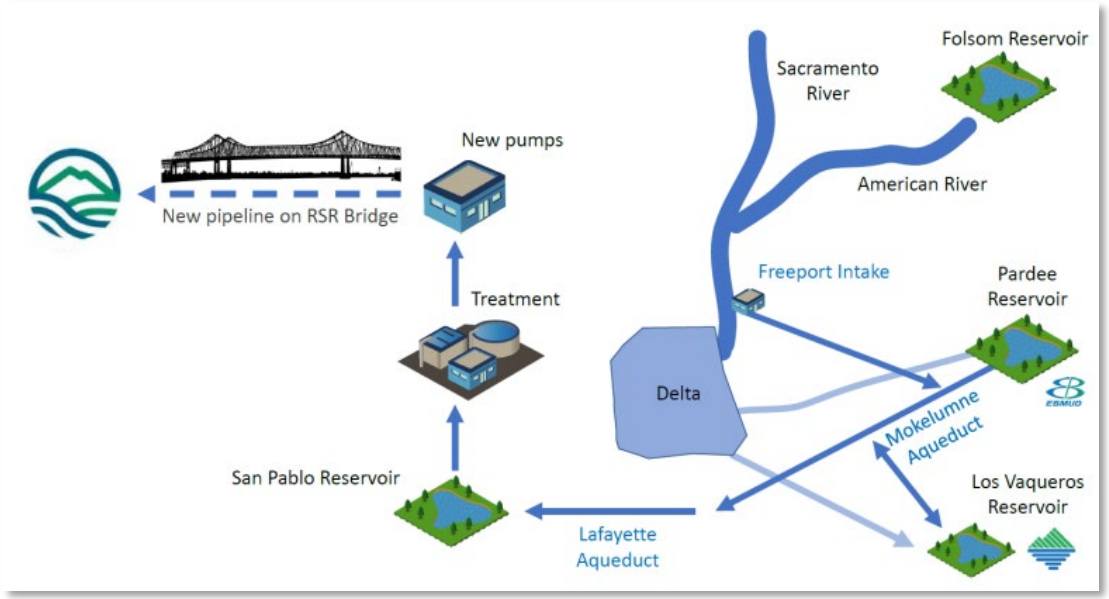
Water Purchases with Conveyance through Bay Interties

1. EBMUD Intertie (Sac Valley purchases)
2. CCWD Intertie (Sac Valley purchases)
3. North Bay Aqueduct Intertie (Sac Valley purchases)
4. SFPUC Intertie (Golden Gate Bridge)



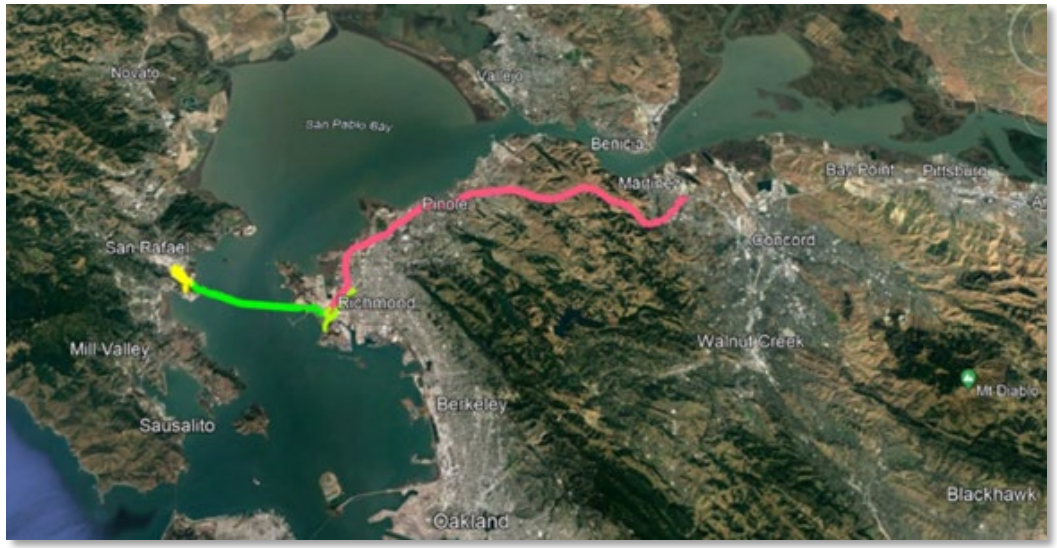
EBMUD Intertie

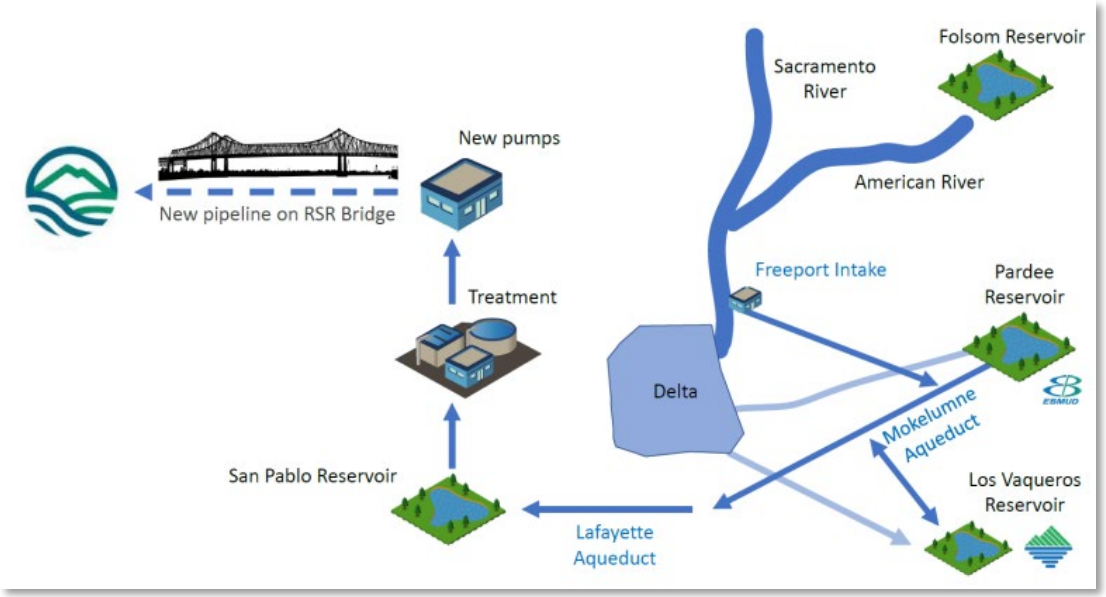
- SAC Valley water purchases conveyed through EBMUD systems
- Pipeline to connect to EBMUD systems and across San Rafael Bridge (6.28 mile 27”)
- MMWD tie in near CMSA
- Richmond distribution improvements for EBMUD customers
- Significant permitting requirements
- EBMUD wheeling principles to be considered



CCWD Intertie

- Sac Valley water purchases conveyed through CCWD systems
- Pipeline to connect to CCWD systems (21 mile) and across San Rafael Bridge (6.28 mile 27”)
- MMWD tie in near CMSA
- Significant permitting requirements
- CCWD regulations wheeling principles to be considered





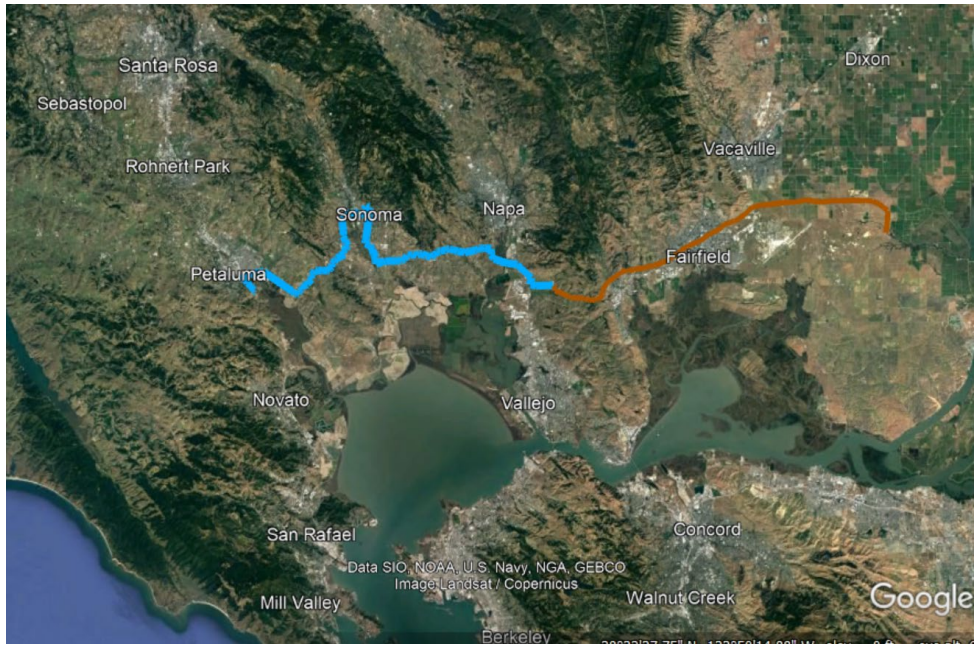
North Bay Aqueduct - Intertie

Option 1

- Sac Valley water purchases conveyed through North Bay Aqueduct
- Pipeline and pump station to connect to MMWD system – Option 1

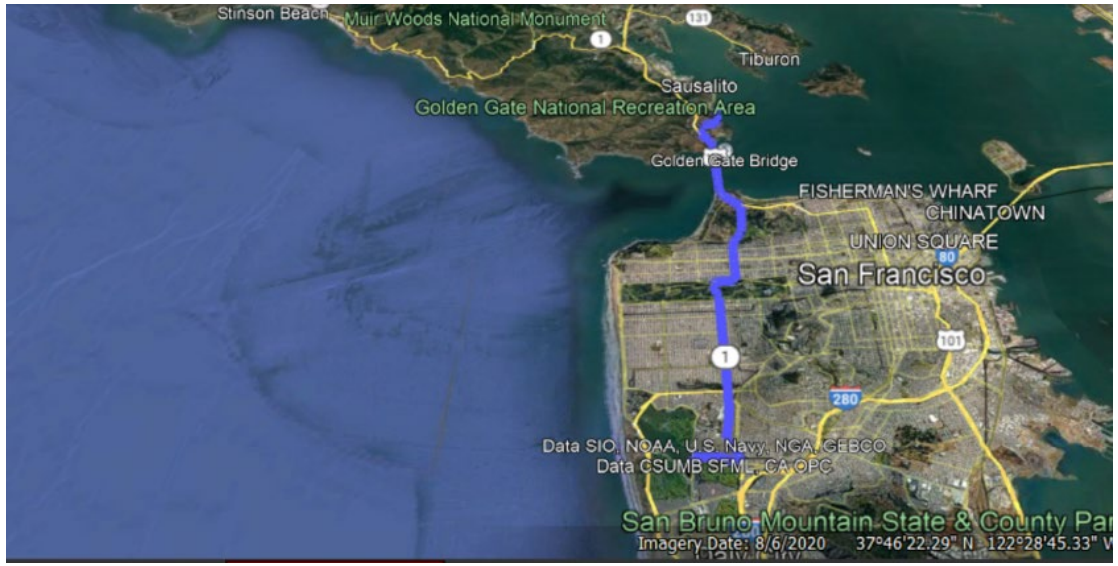
Option 2

- Potential connection to Sonoma Water system for regional supply – Option 2
- Potential partnership with Sonoma Water



SFPUC Intertie

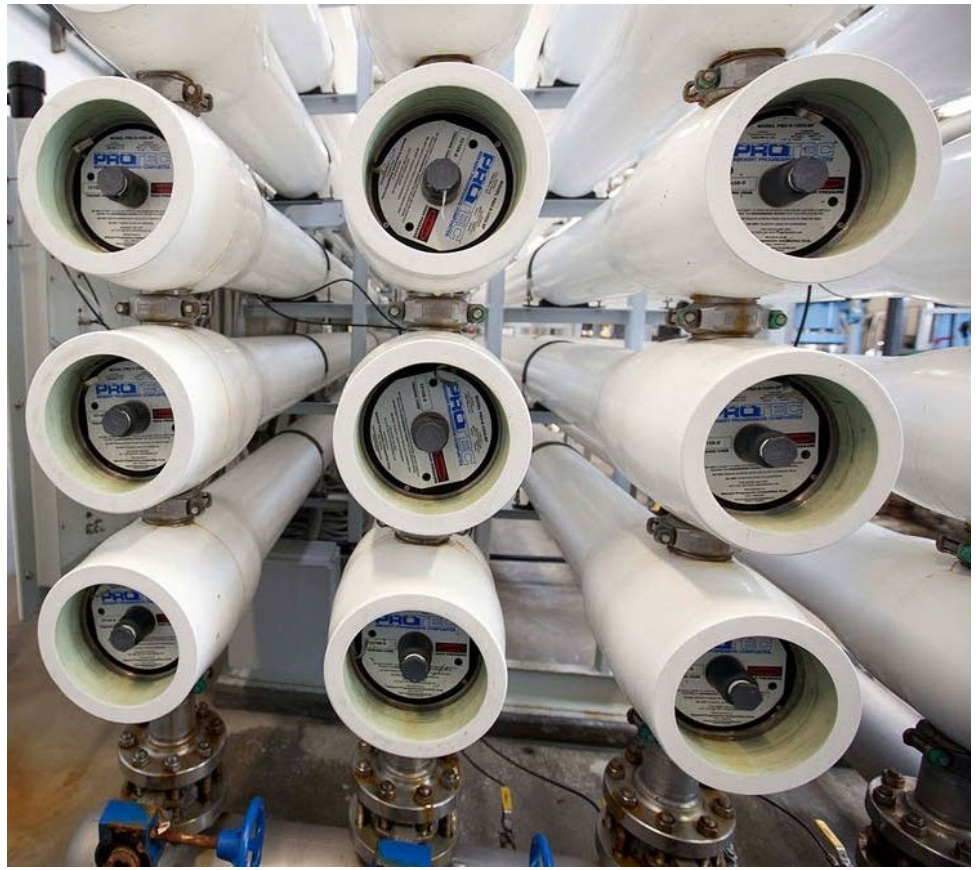
- SFPUC purchases conveyed through SFPUC systems
- Pipeline to connect to SFPUC systems and across Golden Gate Bridge (18”)
- MMWD tie in near Sausalito
- Significant permitting requirements
- SFPUC and BAWSCA regulations and wheeling principles to be considered



Desalination

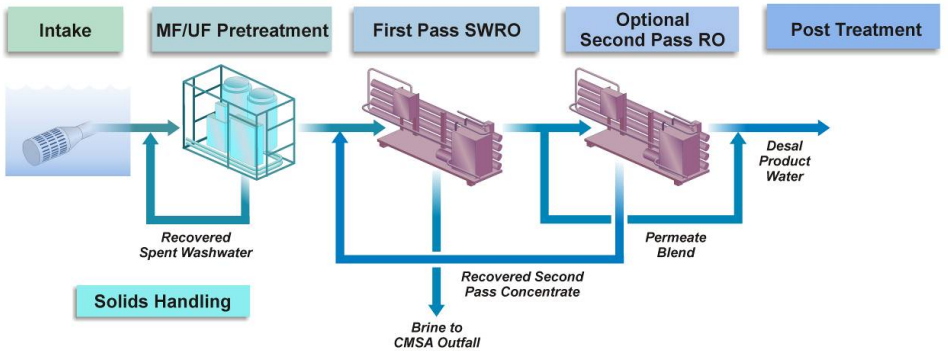
Desalination

1. Marin Regional Desalination Facility
2. Containerized Desalination Facility
3. Bay Area Regional Desalination Facility
4. Petaluma Brackish Desalination Facility



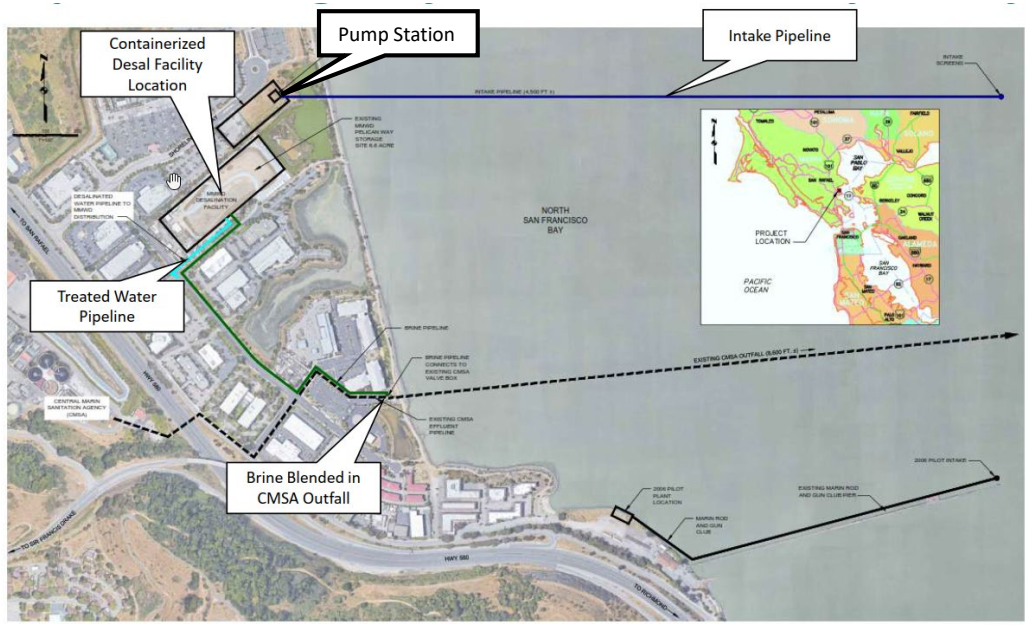
Option 1: Marin Regional Desalination Facility (MRDF)

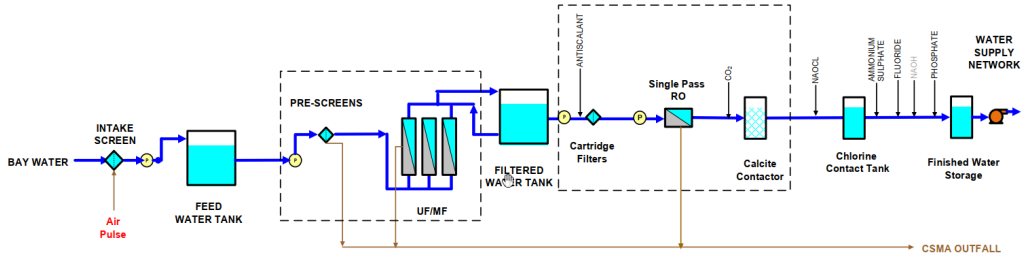
- Description
  - Permanent facility at Pelican Way storage site
  - Intake pump station on un-developed property north of PW site
  - 5-mgd capacity, expandable to 10 or 15 mgd
  - Treated water connections to existing distribution system in Forbes and Ross pressure zones
- Treatment Process
  - Open (screened) intake and pump station
  - Strainer (fine screen)
  - Micro- or ultra-filtration with coagulant feed
  - 1st pass reverse osmosis (RO)
  - 2nd pass RO (optional)
  - Post treatment (remineralization, disinfection, corrosion control and fluoridation)
  - Residuals treatment and offsite solids disposal
- Brine discharge to CMSA outfall
- Considerations
  - Update of EIR and CEQA
  - Considerable timeline to obtain all required permits
  - O&M strategy if used for drought mitigation only



Option 2: Containerized Desalination Facility

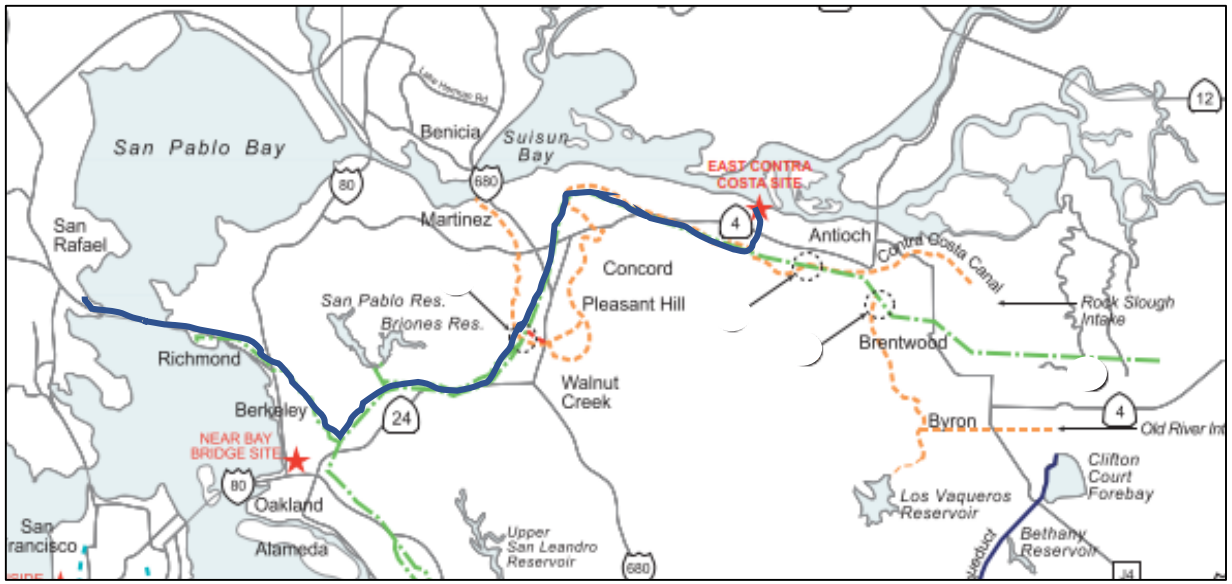
- Description:
  - 5.4-mgd capacity (three 1.8-mgd systems)
  - Integrated, containerized system for process equipment
  - Containerized equipment purchased; amortized over 20-year period
  - Remainder of facility amortized over 30-year period
  - Default provider: Osmoflo (Australia); other providers (Suez, Seven Seas)
- Treatment Process:
  - Open (screened) intake and pump station
  - Strainer (fine screen)
  - Micro- or ultra-filtration
  - 1st pass reverse osmosis (RO)
  - Post treatment (remineralization, disinfection, corrosion control and fluoridation)
  - Treated water stored and pumped into distribution system at Francisco Way
- Brine (and backwash waste) discharge to CMSA outfall
- Considerations:
  - Update of EIR and CEQA
  - Considerable timeline to obtain all required permits
  - O&M strategy if used for drought mitigation only
  - Equipment availability and reliability

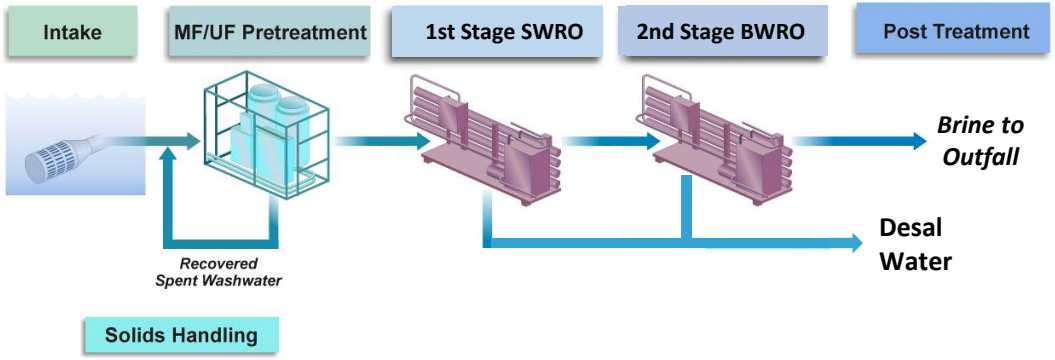




Option 3: Bay Area Regional Desalination Facility (BARDF)

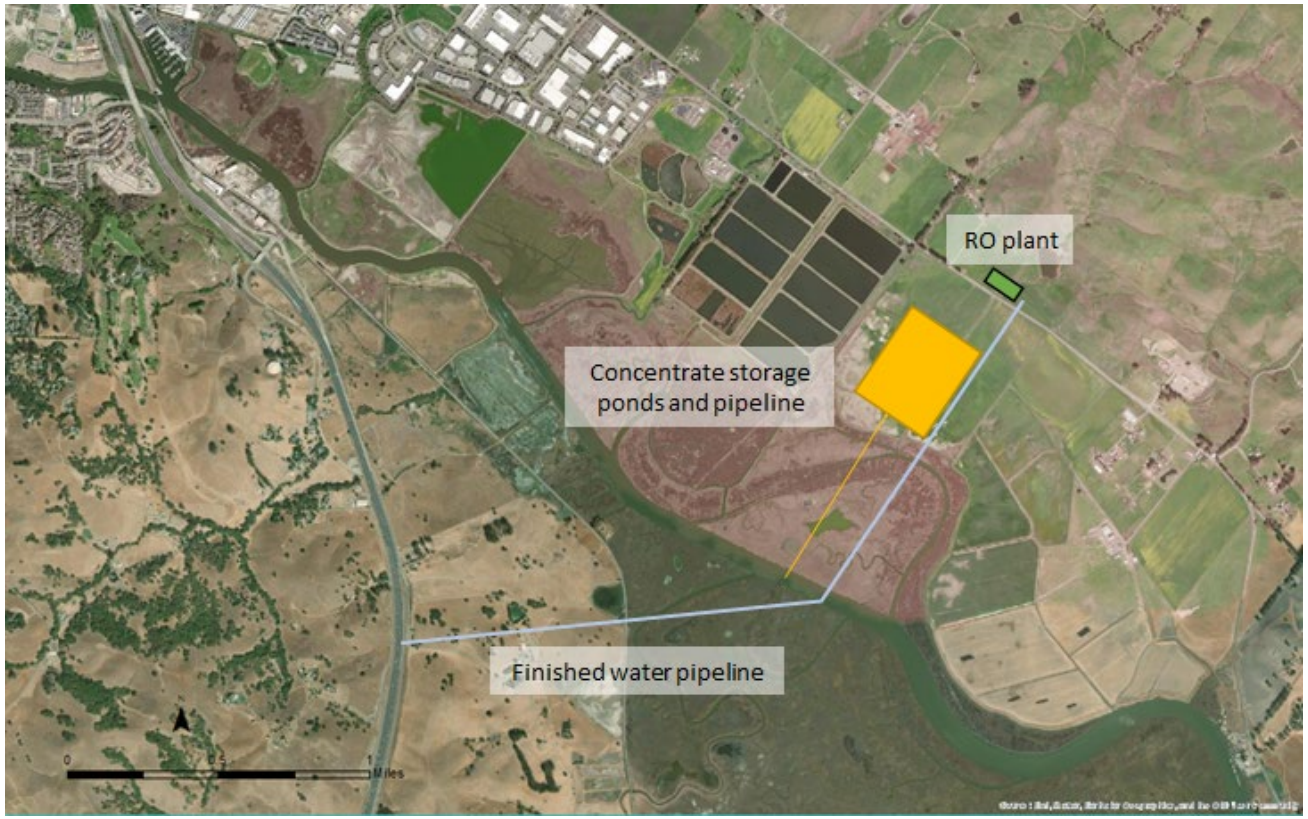
- Partners
  - CCWD, EBMUD, SFPUC, Valley Water, Zone 7 Water Agency
- Description
  - Intake (existing) and desal facility at CCWD Mallard Slough site
  - 20-mgd capacity; 5 mgd dedicated to MMWD
  - Treated water wheeled to Pelican Way site
  - Store and pump from Pelican Way into distribution system (similar to Option 1)
- Treatment Process
  - Similar to Desal options 1 and 2 except:
    - 2-stage seawater/brackish RO system
    - Higher recovery (82 versus 45%)
- Brine discharge to CCCSD or DDSD outfall
- Considerations
  - Availability of water given other partner's needs
  - Minimal MMWD permit requirements
  - Fewer project permits and shorter permitting

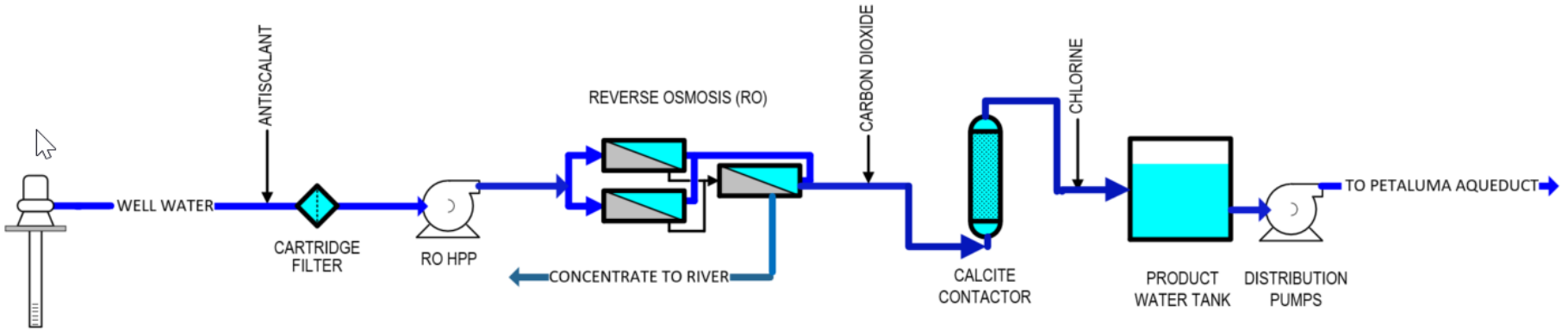




Option 4: Petaluma Brackish Groundwater Desalination Facility (PBGWDF)

- Description
  - Six shallow, 1-mgd wells located in Valley and Plain aquifer near City of Petaluma (1,000 mg/L TDS)
  - 5-mgd brackish water desalination plant
  - Treated water pumped into Petaluma Aqueduct and blended with Sonoma chlorinated water
- Treatment Process
  - Minimal pretreatment (antiscalant/cartridge filtration)
  - 2-stage brackish RO system
  - 85% recovery
- RO concentrate (brine) discharged to Petaluma River continuously or seasonally (via storage ponds)
- Considerations
  - Well locations, yield and quantity
  - Ability to discharge brine to river
  - Land availability and ROW acces





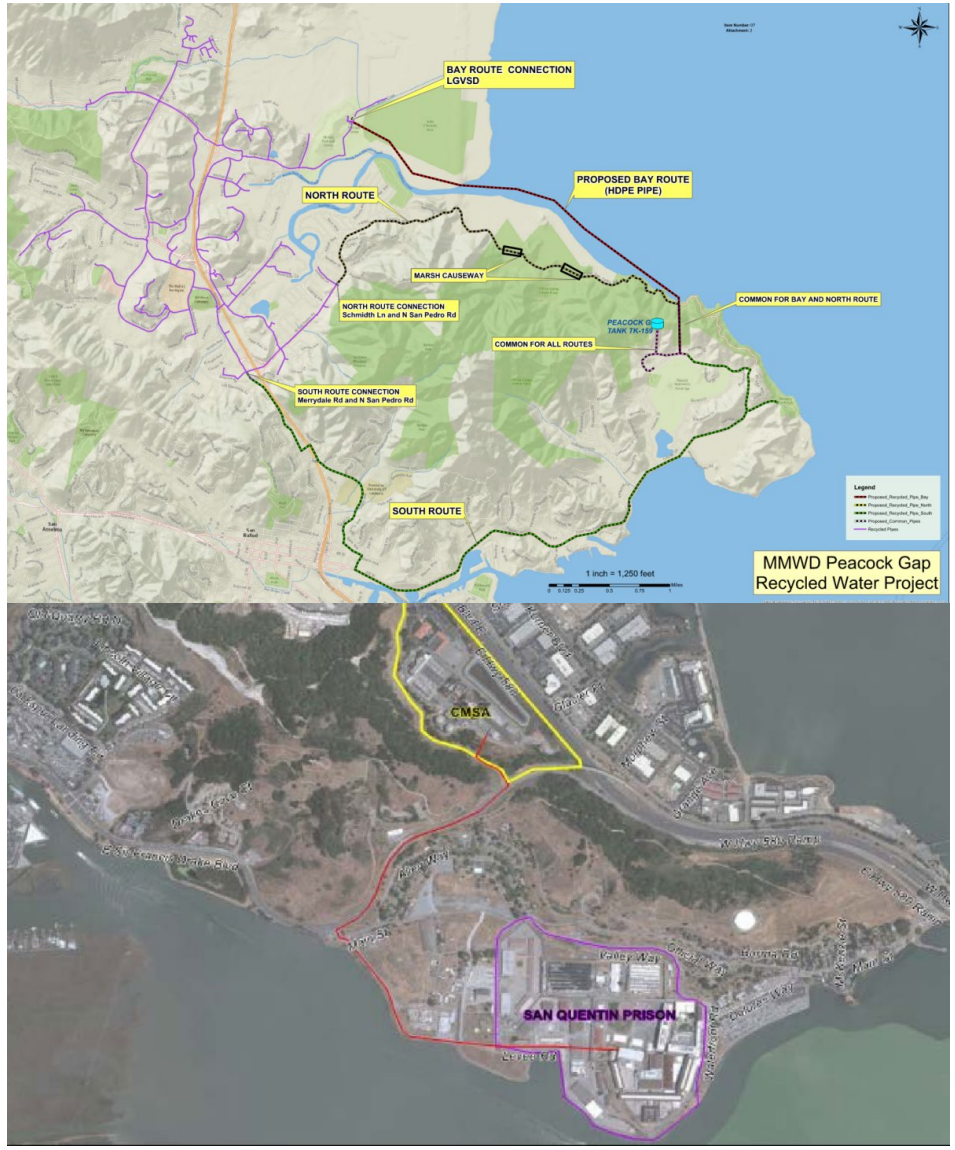
Water Reuse

Water Reuse

1. Recycled Water – expansion of non-potable reuse system (LGVSD-Peacock Gap; CMSA-San Quentin)
2. Indirect Potable Reuse (IPR) – Advanced treatment, discharge to Kent Lake
3. Environmental releases – Discharge to Kent Lake (Folded in IPR)
4. Direct Potable reuse (DPR) – Advanced treatment for DPR, CMSA to distribution system, or discharge to Bon Tempe Lake for Bon Tempe WTP intake

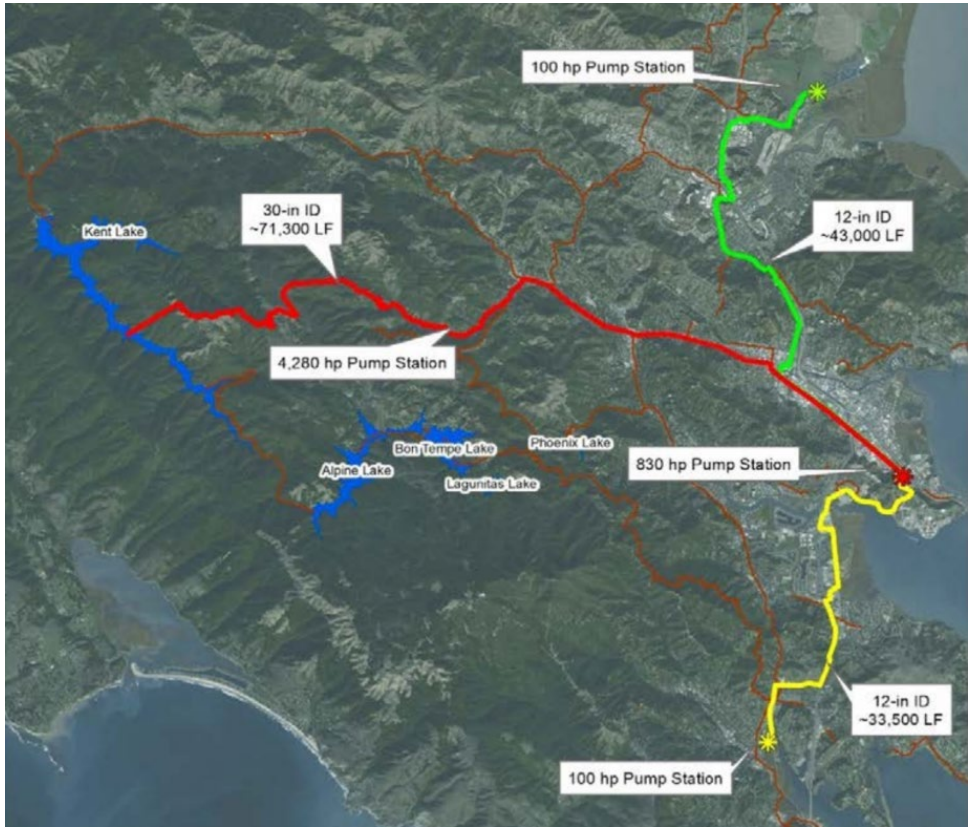
Option 1: Non-Potable Reuse Expansion

- Description:
  - Expansion of LGVSD RW distribution system to provide disinfected tertiary RW to Peacock Gap Golf Course (285 AFY)
    - Ongoing project, using existing 5 MGD LGVSD recycled water treatment plant for disinfected tertiary
    - Current 30% design estimate at $26.7M
    - Annual Demand 285 AFY
  - Installation of membrane (MF) at CMSA, provide disinfected tertiary RW to San Quentin Prison (154 AFY)
    - Identified in Water Supply Plan 2040, constructing microfiltration-based disinfected tertiary treatment plant
    - Delivery of recycled water to San Quentin Prison for non-potable reuse
    - 6-inch, 3,800 LF distribution pipeline
    - 50 HP 290 gpm pump station
    - Annual Demand 154 AFY
- Considerations
  - Demand is seasonal, limited volume
  - Other non-potable reuse options considered are small yield (less than 150AFY)



Option 2: Indirect Potable Reuse (IPR)

- Description
  - Collect secondary effluent from LGVSD and SASM to CMSA
  - Provide Advanced Water Purification Facility with 7 mgd yield = 7,840 AFY treatment capacity.
    - Ultrafiltration, Reverse Osmosis, UV-AOP, RO reject to CMSA outfall
  - Net yield at 7300 AFY due to low effluent flow in summer
  - Advanced Water Purification Facility designed to meet Surface Water Augmentation IPR treatment requirements:
  - Convey purified water to Kent Lake
  - Discharge RO reject to CMSA effluent
  - Purified water delivered to Kent Lake could be considered as either surface water augmentation IPR or in-lieu stream flow
- Considerations
  - Water balance (secondary effluent availability for IPR)
  - Discharge permit for RO reject
  - CMSA footprint to accommodate the AWPF
  - Kent Lake is primary release for Lagunitas Creek



Option 3: Direct Potable Reuse (DPR) - CMSA

- Description
  - Advanced Water Purification Facility at CMSA
    - **4a Only treat CMSA effluent to produce up to 4 mgd purified water, conveyance to Bon Tempe Lake (raw water augmentation),**
    - **4b Only treat CMSA effluent, connection to exiting distribution (treated water augmentation) at up to 4 mgd purified water, or**
    - **4c Convey secondary effluent from LGVSD and SASM, produce up to 7 mgd purified water and convey to Bon Tempe Lake (raw water augmentation)**
  - Advanced Water Purification Facility targeted to meet current DRAFT DPR treatment requirements:
  - Treatment Trains include:
    - Ozone/BAC
    - Ultrafiltration
    - Reverse Osmosis
    - UV-Advanced Oxidation
    - Chlorine contact
    - Dechlorination (for Bon Tempe discharge only)
    - Purified water transfer pump station
    - Engineered Storage/Bon Tempe Lake discharge
    - RO reject disposal to CMSA outfall
- Considerations
  - Water balance (secondary effluent availability for DPR)
  - Discharge permit for RO reject
  - CMSA footprint to accommodate the AWPF